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China Report

SCIENCE AND TECHNOLOGY

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CHINA REPORT

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NATIONAL DEVELOPMENTS

CHINESE STUDENTS IN U.S. REAFFIRM TIES WITH CHINA

Beijing RENMIN RIBAO (Overseas Edition) in Chinese 22 Feb 86 p 2

[Article by Li Xiaobing [2621 1420 0365], graduate student in the United States: "Our Future Is Joined With That of Our Mother Country"]

[Text] Selection After Obtaining An Academic Degree

There are more than 360 overseas students and visiting scholars from China in the Pittsburgh area. In conversation, people cannot help but ask: after you graduate, will you remain in the United States or return to China?

The problem of returning or staying is a common one among overseas students from all countries who come to the United States. After the war, the United States attracted a large number of the cream of foreign talent, especially from the developing nations, because of its foremost position in science and technology, its modern working conditions, its generous wages, and through its opportunities in higher level education and in continuing education. According to statistics from the Taiwan Ministry of Education, about 80,000 students have come to the United States since 1952, from which only 5,000 have returned to Taiwan, less than 6 percent of the total. This is a startling percentage. People with insight in Taiwan cannot help but be concerned about this enormous drain of talent.

Overseas scholars from mainland China are also faced with a similar problem: selection after obtaining a degree.

Hu Chuanwen [5170 0278 2429], a student in the nuclear engineering department of the Carnegie-Mellon University, earned his doctorate in nuclear power engineering in only 3 years and 3 months, which was a record for this department. However, what is of more interest are his research accomplishments in the management of nuclear reactor fuels. The authoritative American journal, NUCLEAR SCIENCE AND ENGINEERING, published his dissertation in its entirety. A year before he graduated, the Westinghouse Electric Company, one of the three leaders in nuclear power engineering in the United States, invited him to work in the reactor division of their company. Faced with the praise and admiration of his American colleagues and receipt of a very high salary, Hu Chuanwen would still often say: working for someone else is not interesting; the only exciting thing would be to build one's own

nuclear project. He often wrote back home to understand the domestic situation in China. Whenever Zhang Fengxi [1728 7685 4406], comrade in charge of the Office of Education at the New York consulate, would come to Pittsburgh, they would get together even if busy with other things. The news that China's nuclear power station project was about to start made Hu Chuanwen very excited. He quickly finished up his work at Westinghouse. Through the introduction of his professor, he paid his own way to travel to more than 10 states, where he looked at a number of American nuclear industry companies, nuclear power stations, and their capital construction sites, from which he gathered a large number of materials. He is currently packing in preparation to contribute his efforts to construction of China's large nuclear power station of the eighties.

Tang Xiaomei [0781 1420 2734] is a self-supported overseas student in the English and American Literature Department of Duquesne, a young lady fond of talking and laughing. She must herself pay the expensive tuition, earn her living expenses, attend classes 5 days a week, work at a restaurant 4 nights, and do housework as a maid 3 afternoons. Each term, Xiaomei takes a full load and also attends school in the summer. She finished her doctorate in literature after only 1 and 1/2 years of a 2-year program. She was so tired that one night she vomited several times, but the next day went to class and work as usual. A male classmate who was concerned about her did not understand this: could it be that she would work so hard and pay her own way to study in America just to "endure this foreign hardship?" She could extend her time in studies, take fewer classes and enjoy herself more, even save a little money. But Xiaomei said that to get her degree earlier would mean she could return and work in China while still young. Both busy and tired, she punctually wrote her mother each week, as well as regularly to her teachers, classmates, and colleagues. And she subscribed to various domestic publications, cutting out materials on American literary studies.

"If one accomplishes something, takes up a cause, and his great aspirations fill the heavens, how then can demons bother him?" Xu Dianzhuang [1776 3329 8369, doctoral student in the University of Pittsburgh Economics Department, expresses his feelings in poetry: "Many times I am drunk with thoughts of home. I sober up in no time, but thoughts of return remain in many strands." Our motherland needs us, and we need it even more. Xi'an Jiaotong University graduate student Li Guofu [2621 0948 4395] went home within a week of getting his degree. Beijing University Professor Wan Ninggang [8001 1337 0474] has just received his doctorate and is also busy preparing to return . . .

Overseas students all feel that only by returning home after getting their degrees and contributing their knowledge to the modernization drive can there be any greater value, any greater significance. Of course, some people are still thinking about this, for this, too, takes time. If we say that scholarly rank is a strong stimulus for selection, then the American dollar is an even greater jolt to considerations of returning home.

Facing Up to the Attraction of the American Dollar

Some people feel that going abroad for study is to "get rich abroad" or to "scoop up extra income." By all means, there are those who will go abroad to

make some American money and then forget to return. But what many overseas students and visiting scholars think of first is not "getting rich," but "strengthening our country." Shanghai Jiaotong University Computer Department Professor Sun Yongqiang [1327 3057 1730] was universally respected in computer circles for the algebraic theory he was researching during his visits to Yale and Maryland University, and within a year he had published several papers internationally. Professor Alan Bo-li-si [phonetic], former chairman of the American Computer Association and first winner of the highest honor in international computing, the "Turing Prize," praised Mr Sun as "a computer scientist of the first rank," and as "having the ability to obtain even more achievements in the forefront of language programming and software design." The computer department of Carnegie-Mellon University, ranked among the top three in the United States, invited Mr Sun to visit there with a generous stipend. After he used his theory in the design and testing of LSI, he accomplished new things. The school wanted him to extend his time, and Dr John Ba-ke-si [phonetic] an American senior statesman in computers and winner of a "presidential commendation," even invited him to work at IBM, but he decided to return to China before that. Many people thought this was a shame. Classmates living in his building made a calculation for him: if he were to stay in the United States just 1 more year, he would make more money than the total of his teaching salary in China for 32 years. "But I cannot stay," said Mr Sun. "The more I see how advanced American computer technology is, I think of how far behind we are, and my face no longer shines and my heart is unsteady. I would return even if I were offered another $30,000 or $50,000 a year. My work is in China, for I want to make our own computer and to lead even more graduate students."

No wonder an American professor praised Chinese students and scholars as having the poise of people from a great nation. They have both fine feelings for their homes and a broader feeling for their country and people. When Lin Tian [2651 3944] of the Xi'an Medical College was studying at the Pittsburgh University Medical School, he was careful of his expenses for food and other things, and before he returned bought many new reference books and teaching tools for his unit. For research needs, Doctor Lin bought more than $3,200 worth of reagents. To keep the reagents at a low temperature of 25 degrees below zero (Centigrade), he also bought dry ice and carried them back to Xi'an by hand. Half of the luggage of Lu Anjian [1687 1344 1017] of the Ministry of Astronautics was documents and materials, for he had not bought anything for himself. When he learned that his unit needed a radio cassette player, he immediately ordered one.

Considerations After a Spouse Comes to America

The state understands the difficulties of students studying abroad and agrees that spouses may leave the country to accompany the student spouse. After the spouse of Wu Jiaxin [0702 0857 9515], Lecturer at the Chinese Academy of Minorities, had been in the United States only 1 month, Lecturer Wu concluded her studies at Pittsburgh because of needs at work. Her spouse immediately packed her luggage for her. People said that he did not come to the United States to accompany her but to "lose money," since his airline ticket had been several thousand dollars. He replied by saying that his coming or going was only for her work. To understand [computer] aided design of advanced

integrated circuits, Li Zhijie [2621 1807 3381], of the Semiconductor Institute of the Chinese Academy of Sciences, brought his food to work every day for the last 2 years. He did not take off on holidays and would often work until 3:00 and 4:00 in the morning. Not long ago, his wife came to Pittsburgh. His life became regular, he got meal after meal of tasty food, and on weekends the two of them would go for walks together. Though his household was peaceful, Mr. Li was not. With time so valuable how can it be used for living? His wife completely understood his feelings, and after they discussed the situation, his wife went back home. She was only in the United States for a few weeks. Now, Mr. Li once again brings his lunchbox, and is even more busy than before.

Doctoral student at the Automation Institute of the Chinese Academy of Sciences, Shen Weimin [3088 3634 3046], used a mathematical model to study artificial intelligence, from which he has obtained preliminary results. His fiancee, Sai Ying [6357 7727], flew to him from Beijing with marriage documents. The wedding was a grand occasion, and the master of ceremonies was the Nobel Laureate, Professor Herbert Xi-meng [phonetic]. Both Chinese and American classmates were happy about their beautiful wedding and rich scholastic careers, and are also concerned about their future. A magazine recently interviewed them. The article concluded with the words of Shen: "We are happy that we can be together. We hope that in American academia we can help develop better relations between the United States and China, and that we can be of help in building a China that is even more prosperous."

According to statistics from relevant departments, 139 overseas students from China have completed their degrees or studies in the Pittsburgh area since 1978. Other than those who have changed fields or continued to another degree, 143 have returned to China, which is more than 90 percent of the total number of students. This is a comforting proportion, which shows the firm confidence the vast majority of overseas students have in their motherland. There is a poem that expresses our meaning: "We would not exchange gold for our feelings of closeness, as sunset reddens the sky, deepening the purple in the east."

12586
CSO: 4008/2083

REFORM OF SCIENCE, TECHNOLOGY MANAGEMENT SYSTEM DISCUSSED

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENCE OF SCIENCE AND MANAGEMENT OF S&T] in Chinese No 1, Jan 86 pp 9-11

[Article by Song Jian [1345 0256], minister in charge of the State Science and Technology Commission: "Science and Technology Policies, Management System Reform and Statistical General Survey"]

[Text] 1. Scientific and technological work should be geared to the needs of economic development and serve economic development. This has been a basic principle established by the CPC Central Committee and the State Council for the past several years. It is a principle we must adhere to for a considerably long period to come.

When this principle was first put forward, particularly when it was formally made public by Premier Zhao Ziyang at a national science and technology awards meeting in October 1982, some comrades including scientific and technological workers failed to grasp its meaning, and some even had doubts and misgivings. Later on, it developed into an epitome, which reads: "Economic development cannot do without science and technology, and science and technology should serve economic development." By the time the CPC Central Committee issued the decision on reforming the science and technology management system in March 1985, it could be said that the great significance of this principle and the role it can and will play, especially the profound impact it will have on the future development of the Chinese nation, were fairly well understood by most scientific and technological workers including some well-known scientists.

Judging by the international situation in the past 2 years, it is true not only in China but even in the developed countries that science and technology are indispensable to national economic development. In Japan, the slogan is "build the country on science and technology." Their science and technology have spurred economic progress. Japanese politicians fully recognize the great significance of science and technology to Japan's prosperity and future growth. In the United States, the Reagan administration has proposed a "star wars" program and planned to spend more than U.S. $100 billion on it, hoping to use such a program to promote high technology development. The United States has always relied on wars to make money. In World War II, other countries suffered great losses, but the United States took advantage

of the war to promote its own economic development. The Korean War gave it another opportunity to make money, so did the Vietnam War. Wars have a stimulating effect to its economic growth. Therefore, some U.S. politicians are inclined to use wars and armament to promote economic growth. Western Europe's Eureka is a joint scientific and technological development program. They hold that the great threat to Europe's future, whether from Japan or from the United States, is mainly from their science and technology. Therefore, Western Europe regards development in science and technology as a matter of fundamental importance concerning its future as nations. Recently the Soviet Union has placed great emphasis on development in science and technology to promote national economic growth, regarding it as a strategic matter in the transition from socialism to communism. There is even the call: "Communist party members step forward, go to the scientific and technological frontline!" It is obvious that all countries have made promoting economic growth with science and technology a matter of national political strategy.

2. The documents on reforming the science and technology management system issued by the CPC Central Committee in March 1985 discussed at length policy matters. The recently held party national conference adopted the party Central Committee's proposal for the Seventh 5-year Plan. In scientific and technological work, we should foster the spirit of hard work, seeking no undeserved reputation, make conscientious efforts to carry out the reforms and continue to guide the scientific and technological force to serve national economic development. In the high-tech field, conditions are not yet ripe for us to engage in full-scale competition with the developed countries. For one thing, we do not have enough money, and our public accumulation funds are insufficient. Another reason is that most of our enterprises are still rather weak in their capacity for self-development and absorbing new technology. High technology in our country today is basically in the "high class" laboratories and in university research institutes, and channels to turn high technology into commodities are not yet wide open. All these must wait for the reforms to succeed step by step, and only then will better conditions be created. During the Seventh 5-year Plan period, the tasks of scientific and technological work are mainly in four areas:

First, we must use new techniques and high technology to transform the traditional industries. Of the existing more than 400,000 state-owned enterprises, many are rather backward in equipment, management and technological standards. They must increase their labor productivity, renovate their equipment and adopt new technologies. This should become an important aspect for scientific and technological work to "serve the economy."

Second, we must set up new industries. Scientific and technological work must be of service to the building of new industries. For instance, has our computer industry brought about the formation of supporting industries? The answer should be not yet. We still cannot produce on our own complete sets of computer systems most needed in society. Banks to this date still count bills by hand, and how can the several hundred thousand savings establishments in the country meet the requirements of the modernization drive? We must form a fairly complete and advanced industrial system and scientific

research system. Therefore, in the Seventh 5-year Plan period, we should devote a part of our resources to building auxiliary facilities for some of the major new industries.

Third, scientific and technological work must serve local economic development. In the past few years, local economic development has brought about a rather lively situation in China, a new prospect in relying on science and technology to develop the rural enterprises. Local economic development should be made an important task for scientific and technological work in China. During the Seventh 5-year Plan period, we should mobilize a part of our scientific and technological personnel to help everyone understand the importance of the rural enterprises and local economic development. [Begin boldface] The introduction of science and technology to the countryside is a matter of both immediate and long-range significance. This is because the reform of agricultural structure cannot succeed without the development of rural enterprises can have no future without relying on science and technology. By combining the two, it will be possible to create a new way suited to China's conditions. Therefore, it should be made a basic policy and adhered to for a long time to come. [End boldface]

Recently the State Science and Technology Commission proposed a "spark plan," which consists mainly of scientific and technological projects aimed at promoting local economic development. The plan will give top priority to the development of livestock breeding and aquaculture in the next few years. Livestock breeding and aquaculture do not require a lot of electric power, energy and materials, and their development will effectively improve the people's material living standards. Their success will also help accelerate the economic reform. If we can promote the vigorous development of the rural enterprises, particularly aquaculture and family livestock breeding, it may provide the pulse to trigger the modernization of the countryside, making it possible for such things as the accumulation of funds, development of qualified people and evolution of production into factory and business types of operations to take root in the rural areas step by step. The application of science and technology to develop the rural enterprises may give a major impetus to the modernization of the rural areas.

Fourth, during the Seventh 5-year Plan period, it is also necessary to give greater support to research projects in basic and applied sciences which are of great significance to national economic development. The state has decided to establish a national science foundation to expand or increase allocations of funds for research in basic and applied sciences. This is because today's new technology will become obsolete tomorrow or the day after. As science and technology are developing so rapidly, if we fail to pay full attention to and keep pace with advanced world levels, we will suffer serious consequences 8 or 10 years from now. Therefore, we must devote a certain amount of resources to keeping abreast of world standards.

3. Our reforms have only just begun. Under the policy of "micro-flexibility and macro-control," it is necessary to expand gradually the decision-making power of the basic-level units, research institutes, and enterprises. The same is true with scientific and technological work. The objectives and

measures for reforming the science and technology management system published in March this year, including granting more decision-making power to research institutes, opening of the technology market, changing the funding system and so forth, are all aimed at invigorating the scientific and technological departments, increasing the vitality of the research institutes and strengthening their willingness and initiative to serve economic development.

However, we have met with a very difficult problem, and that is how to strengthen macro-control on the basis of micro-flexibility. We lack monitoring means for macro-control. To control a machine, you must know its running condition. You must measure whether the temperature here is too high or too low, and whether the pressure there is too great or too little. Only when you have all the output and input data, will you be able to know if the machine is running normally and how it should be controlled. But in the past we lacked this kind of monitoring means in the management system of scientific and technological work, and this has created a very big problem for macro-control.

For example, recently people everywhere are talking about the problem of scientific and technological personnel holding more than one job or being transferred from one place to another. This is a very big policy problem. There are two totally different opinions. The debate between the two opinions is still going on. The leading comrades in some places say that they will not allow a single scientific or technological worker to leave from now on. They say that the scientific and technological workers are lovely, and that they will "hold" them fast and not let them go. These comrades mean well, but eventually the scientific and technological personnel will be rendered useless by the strangle hold. Therefore, some comrades say that science and technology are a social activity, that science and technology must be dissimenated before they can have an impact on mankind and its way of production and life style, and that "moving from place to place" is the law. This has been a heatedly debated question all along. Is it good to allow scientific and technological personnel to move from place to place or not to allow them to do so at all? There is no statistics in actual work. From an overall viewpoint, how much moving will have an "adverse effect on work," and what is a suitable level of movement after all? No one knows for sure.

We have no data, and we have no information. As people say, we are drowning in data, but we are hungry because we have no information. When decisions are being made and people ask us for figures, we have to figures to tell them.

The party Central Committee points out in its proposal for the Seventh 5-Year Plan that we must rel- on policy and science. Neither policy nor science can work without data.

Yet our science and technology departments do not have data, as they are even more backward than the economic and population departments. China's population problem is a most complicated problem but there are population data now. In contrast, the science and technology departments, which should be the most scientific places, are far from being scientific. It really makes people feel ashamed.

We should make up our minds to get statistical work started on science and technology. Lenin said: "To know society, one of the most effective weapons is social statistics." In the past, our scientific and technological circles lacked this weapon, did not have a monitorial means or statistical system and were unable to grasp the laws governing the changes of the macro-parameters in good time. What were left could only be some blind, random phenomena. It is extremely dangerous to allow these phenomena to affect our feelings and rely on these feelings to implement policies.

We suffered in the past, and we must not allow the same to happen again. Therefore, on 11 September 1985, the State Council Science and Technology Leading Group decided to conduct a nationwide science and technology general survey in the coming winter-spring period. This was an extremely important decision. With the help of the state statistics bureau and various ministries and commissions, a statistical system has already been drafted. It is hoped that work can be started at the end of 1985 to produce a fairly detailed description, a quantitative picture, of China during the final year of its Sixth 5-year Plan, to be used as the basis for future statistical work on science and technology. At the same time, it is planned that some samplings be made of 1984 as a review of the situation in that year. Then concrete analyses can be made to see the results of our reforms, how much progress we have achieved and how effective each policy has been. We hope that this type of survey can be institutionalized and continued to put our macroeconomic policy decisions on a solid scientific basis and gradually to become a part of our national statistical system.

To accelerate the reform process, we must establish at the same time a scientific system for the management of science and technology. I think it is for our generation of people to see to it that such a management system is set up and adhered to, for this is the only way to lead our society forward on its way toward modernization. Comrade Hu Yaobang said that each generation of people must fulfill the historical tasks faced by itself. Establishing a sound statistical system for scientific and technological work is one of the historical tasks faced by our generation. We should do a good job in this capital construction project.

The current general survey involves independent research and development institutions and large and medium-sized industrial enterprises; the time is limited; and, in addition, we are all rather unfamiliar with a statistical system. We lack experience, and the difficulties we face are formidable. Nevertheless, we should be determined to carry out the task. It is hoped that we will unite together and work in concert to make the general survey a success and lay a foundation for the system. Contributions made in this area are by no means less important than any other contribution. They are of great significance.

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REFORMS, EFFICIENCY OF RESEARCH INSTITUTES DESCRIBED

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENCE OF SCIENCE AND MANAGEMENT OF S&T] in Chinese No 1, Jan 86 pp 14-15

[Article by Luo Runchang [5012 3387 2490], of the Guangxi Light Industry Research Institute: "Reforms and Efficiency of Scientific Research Institutes"]

[Text] 1. Reform of Old Project Selection Method

In the past, research projects at our institute were generally ordered by higher authorities or assigned by our own leadership. More often than not, the research projects were not geared to specific production needs and were of little economic value. The results achieved could hardly be spread for application in production. For example, the research on cellulose enzyme was a project ordered by higher authorities. If successful, it could turn many fibrous matters into sugar and bring benefit to mankind. However, it was rather removed from actual production conditions. Although several years of research did make progress and produced results, there was no visible economic benefit. In the end, the results became samples and display items and were not used in production. To change this passive situation, in light of the fact that the institute's main job is research in applied technology, we put forward the principle that projects should be selected around "one focus" and should "serve seven purposes": They should be selected around the focus of increasing economic returns and should serve the purposes of improving product quality, enhancing the usefulness of equipment, increasing the variety of colors and designs, conserving energy, reducing production costs, improving the people's living standards and readjusting the national economy. In the present situation, if the results of a research project cannot bring better economic benefit, they certainly will not be popularized and applied by factories and other users. Therefore, whatever purpose a research project is supposed to serve, its ultimate objective must not be removed from the "one focus," that is, to increase economic returns. In actual selection of research projects, we have adopted the method of free selection with leadership approval. The institute's leadership will give its approval to any research project proposed by the scientific research personnel, so long as it is in line with the "one focus" and serves the "seven purposes" mentioned above.

2. Attempt at Free Grouping

In the past, after a research project was decided on, the responsible person and members of the research project group were as a rule appointed by the leadership. The main shortcoming of this practice is the lack of mutual understanding among members, and when there are contradictions, a lot of time is spent on making peace at the expense of research. To solve this problem, we have adopted the method of combining free choice and leadership approval in forming research project groups. This has many advantages: 1) People who like each other and share similar ideas can be in the same group and work in concert to do a good research job. 2) The responsible person of a research project is self-recommended, and he will try to find a way to produce results, for otherwise no one would want to work with him. 3) Members of a project group have an incentive to study and work hard, for if they don't they can be dismissed by the project leader. Fairly good results have been achieved since this practice was adopted. Not only are research projects completed in shorter periods of time, but they are producing better economic results. Our institute undertook a project to make tortoise-marked Xuan paper using Guangxi fir bark as raw material, and the free-choice method was used to form the research group. As a result, it took only 4 months to do the job from the beginning of the project to the time up-to-standard products were trial-produced and put on trial sale, one half the average time required to complete a project at the institute in 1983.

3. Adopting New Measures for Tackling Key Problems

In the past, we had held the one-sided view that a research project had only to produce a treatise and experiment reports. Therefore, research on key scientific problems often took place only in laboratories, turning out scientific data which had little to do with actual production. Because of this, results from research were rarely turned into direct productive forces to produce a notable impact. In the past few years, we have changed this practice. In the process of tackling key scientific problems, we insist on linking research with production, paying attention to both laboratory experiments and solving production problems, so that results from research can be promptly applied to production to bring obvious economic benefits.

In the process of tackling key scientific problems, it is necessary to break down the barriers between departments so that achievements from scientific research can produce greater benefits. In the past, as a light industry research institute, we could only cooperate with light industrial plants in our research. Now, we have torn down the restriction of departmental barriers. For example, the L-lysine, successfully made from waste sugarcane molasses by our institute, had an extraction rate of only 65 percent, much lower than the international standard (85-95 percent). We "walked out" of the light industry field to work together with the autonomous region's experimental chemical works and finally succeeded in raising the lysine extraction rate to 80 percent, with a highest record of 93 percent, surpassing the present domestic standard, reducing unit production cost by 15 percent and deriving greater benefit from the technological achievement.

4. Paying Attention to Popularization and Application of Achievements

Through the reforms, research has been closely linked with production, which provides the precondition for the popularization and application of technological achievements, but which does not mean that these achievements will automatically be popularized and applied in production. Attention must be paid to publicity, introduction and transmission of information even for technological achievements with rather obvious economic benefits so that they will be actively popularized and applied by the production departments. Specifically it is necessary to do the following: 1) report to higher authorities to give the leading organs a concise description of the results achieved and win their support for the popularization and application of the achievements; 2) introduce the achievements through newspapers and magazines and by distribution of printed materials, so that the public will understand the effects and benefits of the technological achievements and actively demand their popularization; 3) hold exhibitions of research achievements to give on-the-spot introduction to their technical characteristics, scope of application and significance to developing production, to attract productive enterprises to popularize and use them voluntarily; and 4) pay return visits to places where research achievements have already been popularized to solve problems arising in their popularization so that the research achievements can be improved continuously and produce even greater benefits.

5. Handsome Rewards for Those Who Make Contributions

Giving handsome rewards to the research personnel who make important contributions--this is an important sign of reform in scientific research and also an important way to implement the principle of distribution according to work and more pay for more work. Facts have proved that this practice can bring into full play the scientists' enthusiasm and encourage them to produce more results faster. In the past 2 years, we have given handsome rewards to the comrades who have produced more results in research, which have qualified for higher levels of awards and brought notable economic benefits at the same time. The forms of rewards are: payment of a one-time cash award, naming as a regional model worker and raise in pay by one or two grades. Since the implementation of the reward system, the number of research projects undertaken each year has increased from 15 to 25 projects; the number of research projects popularized and put to use increased from 3 or 4 to 6 or 7; the number of research projects winning awards increased from 4 or 5 to 7 or 8; and income from research increased by more than 20 percent.

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BEIJING INDUSTRY'S TECHNOLOGICAL TASKS FOR 1986

Beijing BEIJING KEJIBAO in Chinese 7 Feb 86 p 1

[Article by staff reporter Chen Zhiqiang [7115 1807 1730]]

[Text] This reporter learned from the Beijing municipal industrial science and technology work conference, held by the municipal economic commission a few days ago, that the city's major tasks in industrial science and technology work this year are: to make sure that the targets of the various science and technology plans, focused on digestion and assimilation of imported technology and its application in local production and on earning foreign exchange from exports, will be fulfilled; to strengthen, with the driving force of reform, macro-control and various basic measures so that the science and technology management system in enterprises and industrial departments at various levels will function smoothly and better serve the technological progress of the enterprises; and to improve the quality and standards of the science and technology management cadres in industry through the formulation of new product and new technology development programs during the Seventh 5-year Plan period on the basis of in-depth investigation and study.

In scientific and technological work in the industrial field, Beijing in the current year will emphasize the development of new products and application of new technologies in the food, electronics and building materials industries; set up a science and technology management system in industrial enterprises operated by rural townships, districts and counties so that a new situation can be brought about in their technological progress during the Seventh 5-year Plan period; do a good job in organizing development of new civilian products by the defense industries and transfer of defense technology to civilian industries; and make vigorous efforts to organize cross cooperation and find an organizational form for partnerships between research and production so that industrial science and technology work will develop in depth and breadth in the Beijing area.

This year in scientific and technological work, the city's industries will adhere to the principle of giving priority to key projects, avoiding duplication, tapping potentials and opening up all channels of cooperation. Items for digestion and assimilation are not only included in the new proudcts, new technologies and scientific and technological cooperation plans, but are

the focal points in the formation and application of these plans. Another focal point of the new products plan is the development of new products to earn foreign exchange through exports. A focal point in popularizing new technologies is the renovation of industrial equipment and other applications with micro-electronics technology. Technological development will be funded with loans or by allocation, and funds will be used on projects which are relatively more risky, more advanced and difficult or can produce greater social benefits. Loans are to be used on projects which can bring quicker and better economic returns. Tax exemption will be granted first to new products for the city developed by enterprises with funds raised by themselves.

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TECHNOLOGICAL ADVANCES IN CHINA'S ENTERPRISES REPORTED

Beijing BEIJING KEJIBAO in Chinese 10 Feb 86 p 1

[Article by staff reporter Chen Zhiqiang [7115 1807 1730]]

[Text] During the Sixth 5-year Plan period, the technological advances in China's enterprises surpassed all previous years in both scale and depth, and the economic results were obvious. Of the newly added industrial output value in these 5 years, about two-thirds were realized through technological advances and consolidation of existing enterprises. According to a survey, every yuan invested in technological renovation can produce 2 yuan in output value and 0.3-0.5 yuan in additional profit and tax.

During the Sixth 5-year Plan period, the state spent more than 140 billion yuan for technological transformation, a 66.6 percent increase over the Fifth 5-year Plan period. Some 200,000 projects were completed and put into production, of which more than 500 involved an investment of over 10 million yuan each. Newly added fixed assets are valued at 110 billion yuan, equivalent to one-fifth of the original value of the fixed assets of all the country's state-owned enterprises at the end of 1980.

Through technological transformation during the Sixth 5-year Plan period, China's steel production capacity increased by 12 million tons, output of coal under unified state distribution increased by 36.4 million tons, transport capacity for shipping coal from Shanxi increased by 30 million tons, cargo-handling capacity of harbors increased by 13 million tons, and energy saved was equivalent to 120 million tons of standard coal.

In the last 3 years of the Sixth 5-year Plan, China imported more than 3,000 items of advanced technologies for transformation of existing enterprises, of which nearly one-third consisted mainly of imported software and two-thirds mainly imported production lines and key equipment. These technological imports gave a powerful impetus to China's industry in improving quality, increasing variety, raising standards, reducing consumption and bringing better economic returns. A good beginning has also been made in digesting and assimilating imported technology. For example, through mastery and application of 246 items of imported technologies, Shanghai has attained the international standards of the 1970's and the 1980's in 70.9 percent and 25.4 percent of these technologies respectively.

In the 5 years, China's enterprises made breakthroughs in a number of major scientific and technological problems. For example, the research on oil recovery during high water-bearing periods conducted at the Daqing Oilfield produced results up to advanced international standards, and during the Sixth 5-year Plan period, crude oil output increased by over 61 million tons. The chemical industry departments developed a series of high-concentration, low-residue new insecticides, replacing the 666, DDV and other harmful insecticides, reducing pollution and protecting the environment.

Of the 40 major new technologies popularized according to state plans during the Sixth 5-year Plan period, more than 80 percent were widely adopted. Seventeen of these new technologies brought more than 100 million yuan each in economic returns, and seven of them brought more than 500 million yuan.

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OUTSTANDING RESULTS FROM GUANGZHOU'S INSTITUTES NOTED

Guangzhou GUANGZHOU RIBAO in Chinese 12 Feb 86 p 1

[Article by Wu Shujin [0702 2579 6855]]

[Text] In the past year, 26 city-run industrial technology development research institutes, which were selected for reform of the science and technology management system on a trial basis, implemented the system under which directors assumed overall responsibility and the system of contracted responsibility for research projects, thus expanding their decision-making power. Some of the institutes also trial-implemented other related reforms such as public bidding and job contracting for research projects and recruiting of middle-level cadres and technical personnel by invitation, which further stimulated the enthusiasm of the scientific and technical personnel and produced notable results:

--Marked increase in scientific research projects. In 1985, 377 new research projects were started, or 29.[illegible] percent more than the 291 projects started in 1984. Of the new projects started in 1985, 195, or 52 percent, were cross-cooperation projects, as compared with 119 or 41 percent of new projects started in 1984.

--Marked increase in scientific and technological achievements and their popularization and applications. In 1985, 139 scientific and technological results were achieved, a 15.8 percent increase over the 120 results in 1984. In 1985, 133 scientific and technological results were popularized and applied, a 15.6 percent increase over the 115 results popularized and applied in 1984.

--Marked increase in economic returns. Net income from transfer of scientific and technological achievements and marketing of intermediate-experiment products totalled 8.7 million yuan in 1985, more than double that in 1984 and nearly twice the total amount of operational funds allocated to the 26 research institutes in 1985.

--Markedly increased cooperation between research and production. In 1985, the city-operated research institutes entered into technological cooperation with more than 160 enterprises, establishments and institutions of higher learning in Guangzhou and other parts of the country. They formed 116

research, production and teaching partnerships of various types, as compared with 56 in 1984.

--Markedly higher enthusiasm among scientific and technological personnel. A large number of scientific and technological personnel voluntarily walked out of laboratories and designing rooms and went to the frontline of production and construction to look for research subjects, popularize technological achievements, solve technological problems and provide technical training and consultation services. The reform of the scientific and technological management system has inspired the scientific and technological workers to develop their wisdom and enthusiasm, increasing the vigor and vitality of the research institutes and making science and technology better serve economic developments.

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GUANGZHOU'S S&T ACHIEVEMENTS LEAD TO ECONOMIC RESULTS

Guangzhou GUANGZHOU RIBAO in Chinese 15 Feb 86 p 1

[Article by Zhang Jinzhi [1728 6930 2535] and Huangfu Huamin [4106 3940 0553 3046]]

[Text] During the Sixth 5-year Plan period, propelled by the reform and the policy of opening to the outside world, Guangzhou's scientific research institutes carried out a series of internal reforms, began the practice of compensated transfer of technological achievements to other organizations and initiated the system of job contracting for research projects within themselves. This has further aroused the enthusiasm of the scientists and technicians; the scientific research force is growing steadily; scientific research conditions have improved; and scientific and technological achievements are numerous and bringing notable economic benefits.

At present, Guangzhou's scientific research units have established ties with more than 160 enterprises, establishments, institutions of higher education and research institutes in the Guangzhou area and other parts of the country to engage in technological cooperation or transfer of technological achievements. They have also formed 116 research, education and production partnerships, which have made it easier to turn scientific research achievements into productive forces and at the same time increased the research institutes' capacity for self-development. According to a survey, the number of research projects undertaken by each scientist in 1985 was more than double that in 1979, and the proportion of scientific and technological achievements popularized and put to practical use in 1985 increased by 27.6 percent over that in 1979. Statistics show that the 26 city-owned research institutes earned a total of 23.2 million yuan, and a net income of more than 8.69 yuan, from transfer of technological achievements in the past year, and thus were able to further improve the working and living conditions for the scientists and technicians.

The ranks of scientists and technicians have brown steadily in Guangzhou. In 1980, there were 134 research organizations of various types, and the number increased to 283 in 1985. At present, the number of scientific research personnel has increased to over 11,000. Most of the city-owned specialized research institutes have their own testing plants or intermediate-experiment workshops, which provide favorable conditions for further development of scientific research.

During the Sixth 5-year Plan period, the city's scientific research units made a total of 6,745 scientfic and technological achievements, of which 7 won national invention and natural science awards, 9 won national technological progress awards, and 210 received provincial awards for major scientific and technological achievements. Based on actual production and economic returns which can be represented statistically, these technological achievements can yield 1.43 billion yuan in output value and 300 million yuan in taxes and profits each year, which are 30 times and 7 times respectively the amounts invested on scientific and technological research projects.

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NATIONAL DEVELOPMENTS

COOPERATION BETWEEN COLLEGE, RESEARCH INSTITUTE NOTED

Shanghai WEN HUI BAO in Chinese 2 Mar 86 p 1

[Article by Zhang Chengjun [4545 2052 6874]: "Frequent Reports of Good News Regarding Benefits and Glory for Teaching and Science Research"]

[Text] Fudan University has joined hands with the Shanghai Branch Academy of the Chinese Academy of Sciences to develop new disciplines and new technologies, is exchanging students and sending "disciples," and has good news to report regarding its full scale cooperation and joint problem solving as an army of researchers along the two paths of higher education and science institutes.

Discipline strengths at Fudan University and the Shanghai Branch of the Chinese Academy of Sciences each have their advantages and inadequacies, but when both parties used the method of "using a person's strengths and supplementing his shortcomings," it brought great benefit to both sides in the aspects of developing new disciplines and new technologies. Molecular genetics is a new discipline, one in which the Shanghai Branch of the Chinese Academy of Sciences Cell Research Institute is rather weak. When the Bioengineering Department of Fudan University was establishing this new specialty, the Cell Institute arranged for its graduate students to go to Fudan for the lectures. Developmental biology does not exist at Fudan, but it is a dominant field at the Cell Institute, so Fudan then sent its graduate students to the institute for lectures. For this purpose, teachers on both sides also hold concurrent positions and teachers are exchanged. As for example where Fudan's physics department and physics department No 2 each send teachers to teach classes in computational physics and high level quantum mechanics for graduate students at the Metallurgical Institute at the Shanghai Branch of the Academy; the Cell Institute and Biochemistry Institute send some graduate students to Fudan to hold concurrent teaching positions.

Certain setbacks for both sides brought on for a time by insufficiencies of equipment and materials have been resolved by their cooperation. The genetics department at Fudan needed to teach behavioral genetics of the fruitfly, but had no equipment for electrophysiological experiments. As it happened, the Biology Institute of the Shanghai Branch of the Academy was fairly well equipped in this regard, so with the help of the Biology Institute, Fudan took up the direction of experimental work. Fudan has a proton electrostatic

generator, so the Optics and Fine Mechanics Institute of the Branch Academy then cooperated in the use of this generator, and using the proton insertion method studied new semiconductor devices. Both sides have opened laboratories, and have provided the equipment and locations for students and scientists of each party to practice and do advanced training. The Genetics Department at Fudan and the Biochemistry Institute at the Branch Academy have made use of the advantages of the technology and equipment situations, and are jointly carrying out research on nationally targetted projects on genetic engineering.

In the past, Fudan and the Branch Academy had only sporadic contacts on projects, but have recently entered the stage of full scale cooperation. Not long ago, more than 80 leaders and specialists from 15 institutes affiliated with the Shanghai Branch Academy went to Fudan for an academic exchange under the direction of Branch President Cao Tianqin [2580 1131 2953]. At the exchange conference, attended by such leaders and specialists as Lin Ke [2651 0344], Qing Zhichun [1987 1807 4783], Xie Xide [6200 1585 1795], Ding Gongliang [0002 0361 6852], Tan Jiazhen [6151 1367 2823], Hua Zhongyi [5478 0022 0001], Gu Chaohao [6253 6389 6275], Feng Depei [7458 1795 1014], and Qiang Lianqing [1730 6647 1987], it was recommended that arrangements be made for discussions concerning the cooperative training of graduate students, making full use of the advantages of both parties in applied research and basic research, for more open laboratories, and with preparations for a "young scientists convention."

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S&T FEMALE ADVANCED DEGREE HOLDERS LAUDED

Beijing GUANGMING RIBAO in Chinese 5 Mar 86 p 1

[Article by Xu Ying [1776 4481]: "Contributions of a Group of Chinese Trained Female Doctorate and Masters Recipients Are Outstanding"]

[Text] From information provided by the National Academic Degrees Committee of the State Council: A group of female with doctorate and master's degrees trained by China's own capability have become a mainstay force in our higher institutions and science and technology units. By the end of last year, 14 female scientists and technicians had obtained their doctorates. Those in the natural sciences were Xu Gongqiao [1776 0501 1564] of the Biology Department of the Chinese Academy of Sciences, Sun Yanhui [1327 3601 1979] of Beijing University, Chen Yunmei [7115 7301 2734] of Shanghai's Fudan University, and Sun Naihua [1327 0035 5478] of the Huadong Teacher's College; in the engineering sciences were Ni Yixin [0242 0110 0207] and Wang Jia [3769 0163] of Qinghua University, Wang Youqi [3769 0645 2759] and Ye Hanbi [0673 1383 4310] of the Shanghai Jiaotong University, and Wang Zhenni [3769 4176 1200] of the Northwest College of Engineering; the medical doctorates were Wang Yunxiang [3769 0061 5046] of the 4th Army Medical College, Cao Chengjing [2580 2110 2417], Xie Cuiwei [6200 5050 5633], and Li Sijia [2621 1835 0857] of the Beijing College of Medicine, and Yang Minghe [2799 2494 3109] of the Chinese Joint Medical College.

According to incomplete statistics, more than 3,500 of this country's young female scientists and technicians obtained master's degrees. These female masters were about 12 percent of masters recipients throughout the country.

Ages of these female doctorates and masters were mostly between 30 and 40. They have worked energetically at their studies and mastered a solid foundation in knowledge to make our country prosper, and many have made outstanding contributions in scientific research or in teaching. Dr Ni Yixin, currently professor in the department of electrical engineering at Qinghua University, in her research into digital simulation of the whole process of electrical power system faults has provided new technology and methods to the safe operation and quality control of power systems, which fills in a gap in this field of research in China. Dr Ye Hanbi, communications and electronics specialist at Shanghai's Jiaotong University, has proposed a new optical model, the theory and technology of which are at contemporary international advanced levels for image processing.

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technical information and which led to talks between more than 20 units. The counties and cities of Fushun, Tieling, and Xiuyan all held this sort of press conference, which contributed to the transmission of scientific and technical information.

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BETTER RUNNING OF TECHNOLOGY MARKETS URGED

Zhengzhou HENAN RIBAO in Chinese 5 Mar 86 p 1

[Article by Ying Hao [5391 6275]: "Technology Markets Must Be Well Managed"]

[Text] The current focus of science and technology in this province is to center on economic construction and the active application and dissemination of scientific and technical achievements. We will organize joint bodies of research, teaching, production, and operations to allow research achievements to become production forces as quickly as possible." This was pointed out recently by CPC Henan Provincial Secretary Yang Zhezong [2799 2124 4844] after listening to a working report from the provincial science and technology commission.

Deputy provincial secretary and provincial governor He Zhukang [0149 4554 1660] heard the report of the science and technology commission at the same time. He said that we will put our primary efforts into application and dissemination of advanced scientific and technical achievements. This is a channel for economic invigoration for which little money is needed, results are quick, that is in compliance with conditions in Henan Province, and that when mastered can race against time to reduce the gap in economic development between this province and more advanced provinces and municipalities. We want to adhere closely to planning for development of the national economy, to clarify research points of emphasis, and to focus on arranging for key problems in science and technology.

When the comrades in charge of the science and technology commission reported on problems with the technology markets, Yang Zhezong said that operating technology markets is an important matter for restructuring the science and technology system, and is also an important component of the entire market regulation system. Just now in the early stages, we want to be sure to manage them well and to continue to support their development. And we must also pay attention to their further solidification, assimilation, supplementation, and perfection. We will not keep on saying that cadres are not permitted to be in business and then close all doors. We must be careful to delineate clearly the bounds between running technology markets and offering compensated service on the one hand, and the engagement in enterprise by party and political organizations, party and political cadres, and service units on the other hand. Under the banner of "technology markets," some people have run fly-by-

night companies and illegal operations, which absolutely cannot be allowed. However, just because a minority of technology markets have not kept to the rules or have misrepresented themselves, we cannot deny technology markets themselves. In the aspects of financial affairs, personnel, and their establishment, technology markets will be separated from the management sector of science and technology and will be accounted independently and autonomously operated.

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EFFECT OF 'SPARK PLAN' ON RURAL CONSTRUCTION DISCUSSED

Tianjin JISHU SHICHANG in Chinese 4 Feb 86 pp 1, 3

[Article by Liu Zhongkui [2692 1813 7608]: "Town and Township Enterprises and the 'Spark Plans'"]

[Text] The modernization of our 800 million rural population is controlling the process of China's modernization.

To meet our grand goal of putting the four modernizations into effect, cities with their 200 million population must march in step with the 800 million in the countryside. If modes of production and lifestyles in the countryside do not change and the economy and education do not flourish, then it will be impossible to realize a revitalization of our people and our "four modernizations." A natural economy still dominates our countryside, the proportion of commodities is low, little has accumulated, and development is slow. In some places, even the problem of keeping warm and getting enough to eat has not been solved. If this goes on, it will lead to regression in the development of our entire national economy, which will affect the process of our "four modernizations."

The reality of the restructuring of the rural economy has caused people to understand the reasoning behind "no wealth without industry, and without agriculture there is no stability." To develop the rural economy we must first adjust rural economic structures and agricultural structures. In the broad sense, what we mean by "industry" is town and township enterprises. Town and township enterprises provide a suitable means to develop a commodity economy and by which to leave the production modes of a natural economy and move toward factory production modes. For example, when families raise chickens, even if a family raises dozens of chickens, per capita output value will not exceed 1,000 yuan. If chickens are raised with factory methods, per capita output value can reach tens of thousands of yuan. It can be seen that in setting up town and township enterprises, we will not only comply with people's situations, indicating a change in production modes and an improvement in production forces, but it will create the conditions by which to use advanced technology. For this reason, the "spark plan" makes use of science and technology to support the development of town and township enterprises, and as such is extremely necessary and timely.

By developing town and township enterprises we can forge a path that will suit Chinese national conditions.

At present, town and township enterprises have become an important component of the national economy. From 72 billion yuan in 1980, their output value rose to 170.9 billion yuan in 1984, which is 17 percent of the gross national product and 34 percent of the gross output value for the rural society. Their output value has risen by 24 percent each year. The development of town and township enterprises will play a big part in supporting the transformation of medium-sized and large cities, in absorbing surplus rural labor, and in spurring on development of overall construction in the countryside.

Some urban industries need to be dispersed, some cities want to establish technically intensive industries, and there are also some industries that are labor intensive, all of which could be dispersed into town and township enterprises. Large enterprises in the city can partially transfer the production of components to town and township enterprises. Because advances in rural technology have stripped away a large amount of labor from planting and cultivation, they can break up the capitalist model whereby "impoverished peasants flow into the cities," and if they are employed in town and township enterprises, this will allow peasants to leave the soil but not the village and to enter the factory but not the city. By the end of 1984 town and township enterprises had solved an employment problem for 50 million people, which was an enormous contribution. The development of town and township enterprises also directly accelerates technical advancement in agriculture and the improvement of education levels. It allows a full scale development of towns and townships politically, economically, technically, and culturally, and has a positive effect on the gradual elimination of "the three great disparities."

Development of our town and township enterprises is changing rural economic structures, agricultural structures, employment structures, and other economic areas. It is changing the deployment of industry in this country, is having a great effect on economic and social life, and has become an important support for rural modernization and for developing towns and townships. In addition, it is having a far reaching effect on solidifying industrial and agricultural alliances, on strengthening relations between the city and the town, and on elimination of the three great disparities. The integration of science and technology with town and township enterprises will forge a path that suits our national situation.

Town and township enterprises must be guided with the support of science and technology.

There are currently two types of development with the town and township enterprises. On the one hand, there is no "eating from the big pot," methods of operation are flexible, there is great autonomy, decision making is convenient, there are fewer levels of management, more is put into production, and there are things that state-run enterprises cannot do as well; on the other hand, technology and management levels are low, the labor productivity rate is low, product quality is lacking, and there is the problem of competing with state-run enterprises for raw materials and energy. For these reasons,

we cannot encourage or limit town and township enterprises in ordinary ways, but must increase our guidance and active support. The "spark plan" is just that support for the scientific and technical development of town and township enterprises.

Currently, we must guide town and township enterprises to stress reliance on local resource advantages in developing processing industries, and that they should not compete with state-run enterprises for energy and raw materials. We should encourage qualified areas to increase production of energy and raw materials for the state. We must be careful not to use obsolete equipment from larger enterprises to run technically backward industries and we cannot develop industries that pollute the environment and that we cannot control. We should guide certain areas in overall planning, and must definitely not abandon agriculture because we are developing town and township enterprises. We should consider the problems of "no wealth without industry" and "no stability without agriculture" together, and make suitable arrangements.

Town and township enterprises lack technology, lack talent, and lack funds. Resolution of funding problems depends largely upon funds amassed from large numbers of people, on support partially from credit and other aspects, and on methods like joint operations. This means that technology and talent are the "fire" that the "spark plan" will give to town and township enterprises. Through selected demonstration sites, the "spark plan" will undertake development of suitable technologies and exemplary production, and will bring production techniques and equipment to the surface. Since demonstration sites are representative, they can promote the technical development of town and township enterprises and of planting and cultivation. Their advanced technology and scientific management, as well as obvious results, can lead other firms to follow good examples. Technical personnel trained under the "spark plan" will come from town and township enterprises. They will receive a short period of training according to the specialty to which they are assigned, and after they have mastered a certain amount of technology they can return to their enterprises to play even greater roles. Based on needs and possibilities, they may undertake training at higher levels. With more than 1million young high school graduates trained and acting as spreaders of the fire, they will play a big part in the development of town and township enterprises and in building the two civilizations in the countryside.

Guard against precipitate action, and guard against the running of "small, indigenous, and mass-run" enterprises.

The "spark plan" was proposed in the spirit of the resolution by the Central Committee to restructure the science and technology system, and is aimed at invigorating the local economy. The goal of the "plan" is to organize 500 demonstration sites during the "Seventh 5-year Plan," train 1 million technical personnel, and develop 100 kinds of equipment lines.

The Central Committee has great expectations for the "spark plan," which means that it is intended to be a fundamental policy carried on for a long time. It is just for this reason that in its implementation we want to guard against

precipitate action, a full scale blossoming, and also want to guard against the "small, indigenous, and mass-run enterprises" of the "great leap forward" days making a comeback in new attire.

The "short, level, and speedy" projects undertaken by the "spark plan" differ from key scientific and technical projects that are medium and long term, and are also different in principle from "small, indigenous, and mass-run." "Small, indigenous, and mass-run" was a product of a political movement that was carried out in the circumstances of the "great leap forward," where agriculture had not yet come of age, that was forced, and worked at the cost of sacrificing agriculture; the "short, level, and speedy" projects of the "spark plan" are undertaken for technical development, are aware of economic results, and are based on the fact that agriculture has come of age and that the public is willing to invigorate the rural economy. "Small, indigenous, and mass-run," means small-scale, indigenous methods, and mass movement; in "short, level, and speedy," turnaround time for results is short, technology is not conspicuous (in contrast to high technology), and topics are quickly determined, developed, and disseminated. Although the two phrases are different in principle, neither can they be ignored in execution.

Primary fields of development in the "spark plan."

Near term emphasis for projects of the "spark plan" is in the areas of what the people eat, wear, live in, and use, as for example in the energetic dissemination and development of factory production technology for domestic fowl, water fowl, aquaculture, and animal husbandry, and in the setting up of small scale poultry raising and aquatic feeding and cultivation areas together with commodity processing plants; in development of factory processing technologies and complete sets of equipment for agricultural by-products, arranging for the importation of equipment, undertaking of absorption and assimilation, and equipping town and township enterprises; on behalf of construction in villages and townships and the building of rural buildings, to provide plans and designs for improving conditions and saving arable land, and to develop new types of building materials, prefabricated components, and small scale construction equipment; to disseminate new technologies for textiles, and to guide the application of new technologies into the production of goods and materials for everyday life. As for example with the design and cutting of clothes, electronic teaching tools and toys, and small commodities that are novel, convenient, or for traveling.

During the "Seventh 5-year Plan," we will rely upon science and technology to construct a group of modern, embryonic small and medium-sized enterprises throughout the countryside, scientific and technical talent by the thousands will be models as the countryside is undergoing a transition from a natural economy to a modern one, and it will be possible to forge a path that has Chinese characteristics and to make great contributions to socialist modernizations.

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RECENT S&T ACCOMPLISHMENTS REVIEWED

Beijing LIAOWANG [OUTLOOK] in Chinese 3 Mar 86 pp 29-30

[Text] Although 5 years is but an instant in history, to 1 billion Chinese striving for a quadrupling of the industrial and agricultural gross output value by the end of this century, it was an important course of progress measured then in seconds. During the 5-year period just passed, science and technology in China advanced by leaps and bounds.

When the "Sixth 5-year Plan" began, the objectives of the struggle as proposed by China's science and technology leading departments were: to use advances in science and technology to accelerate the development of the national economy, through arranging for science and technology, to tackle key problems to make breakthroughs in key problems among weak links in the national economy, like energy conservation, energy exploitation, transportation and shipping, and the comprehensive utilization of natural resources. The objectives included providing advanced science and technology for environmental protection, town and village construction, medicine and hygiene, and family planning, all for the advancement of all of society. Now, the 5 years have gone by, and comrades from departments concerned have excitedly told reporters that with the great efforts of scientific and technical workers throughout the country there have been great advances in 38 key scientific and technical projects and in 40 projects for the dissemination of new technologies. Many achievements from the key projects have been used in industrial and agricultural production; development of projects to disseminate new technologies has also been quite rapid. There has been a series of important accomplishments in science research and in the development of technology, more than 700 projects having been awarded the national prize for invention.

In aspects of agriculture and animal husbandry, improved varieties of rice, wheat, corn, cotton, tobacco, and livestock cultivated in all areas have been spread and are flourishing over a large area, and the rate of production growth has been very great. After our country for the first time promoted the technology of making rubber [plants] more tolerant to northern conditions, dry rubber production for 1984 reached 170,000 tons.

In the industrial sector, we successfully manufactured the world's largest low-head generator assembly, having an installed capacity of 175,000 kw, as well as large scale open pit mining equipment and 500 volt output transformer

equipment; breakthroughs were made with new types of open-end spinning, self-twisted spinning, and air-jet loom spinning and weaving technology; and we have resolved the technology for the comprehensive utilization of the three great paragenetic mines at Panzhihua, Jinchuan, and Baotou.

In the fields of rising new technologies, China's electronic information technology has begun to take off, and microcomputers are being more widely used day by day; fiber optic communications are on their way to being used, and a fiber optic communications relay system has been built between urban telephone exchanges in Shanghai, Tianjin, Wuhan, and Nanjing; we have established biological engineering industries, such as for antibiotics, vitamins, amino acids, organic acids, ethanol, and zymins, all based on fermentation engineering, and in addition to this, have also developed thousands of new types of materials.

Among the many scientific and technical achievements, we cannot but say more about some of the outstanding accomplishments and award winning projects during the "Sixth 5-year Plan."

Long-grain hybridized rice. Horticulturist Yuan Longping [5913 7127 1627] and others used modern breeding technology to raise this new variety of hybridized rice, winning the first special prize for invention since the founding of our nation. Under similar conditions of production, this variety of rice can yield on the average more than 100 jin per mu more than other varieties. In 1982 this achievement became the first agricultural technology to be sold to the United States.

In 1985, there were 1,772 scientific and technical achievements throughout the country awarded national prizes for advancements in science and technology. Those among them winning the special prizes were:

New technology breaking through the "forbidden area" in creating the Chengdu-Kunming Railway. To create this railway, many scientists and technicians worked for more than 10 years to select the railway route. They climbed overhanging precipices and walked along precipices and evaluated more than 300 plans before selecting the best positions for the line and avoiding poor geographical areas. In the construction process, they researched and used 54 new technologies, which was unprecedented in the history of road construction in China.

New bridge construction technology for the construction of the Nanjing Changjiang Bridge. Its construction signified that bridge construction technology in China has reached advanced world levels. After traffic was permitted on the bridge after 1983, the annual volume of railroad cargo was 160 million tons, which is 9.85 times that ferried across before trains could cross the bridge; time to cross the bridge was reduced from 2 hours to 5 minutes; an average of 13,000 motor vehicles cross the bridge each day, which according to calculations for through traffic capacity is 20 times that before the construction of the bridge.

During the past 5 years, China's computer technology has also advanced rapidly. In addition to the various kinds and types of microcomputers making

the most of their abilities within various fields, Chinese scientists and technicians have used exclusively domestic materials and successfully created a 10 million operations [MIPS] vector computer, and have developed a 100 MIPS supercomputer. Only a few countries in the world today can produce supercomputers. Successful development of 10 MIPS and 100 MIPS supercomputers shows that China's computer technology has leaped into the ranks of world leaders, and makes it possible to use domestically produced computers exclusively for the large-scale problems of petroleum and geologic exploration, medium- and long-range numerical weather forecasting, satellite graphics processing, and in the building of national defense.

The potential of science and technology was also evident in areas of overcoming natural disasters. From 1981 through 1984, scientific workers successfully forecasted major weather disasters, which allowed China to avoid enormous losses. Because of the accuracy of forecasts regarding water conditions, the Jingjiang was not diverted for flooding, which saved 100 million yuan in removal expenses alone. In other instances, as for example on the four occasions of disastrous weather that were the devastating rainstorms at the project to prevent flooding at the Longyangxia hydroelectric station and at Ankang, as well as in the Beijing area and in the northeast, the forecasting was accurate. The level of forecasting has attained or exceeded international standards.

More than 100 years ago, a young surgeon from Switzerland named Michel discovered nucleic acids in the pus cells of a patient's bandage, later finding that these were macromolecules existing in all living matter, that they are the medium for genetic emissaries of living matter and for compound proteins, and that they are as well one of the most fundamental materials that make up life. This earth shaking discovery posed a question for scientists: can we use artificial methods to synthesize these fundamental materials of life? If we could do it, we would have hopes of clarifying the mysteries of life. After artificially synthesizing bovine insulin for the first time in the world, Chinese scientists then immediately set to work studying this problem. After 13 years of arduous exploration, at the end of 1981 they had successfully accomplished complete artificial synthesis of RNA transfer in yeast analines. This accomplishment shows that we have taken another step forward in the area of artificial synthesis of the basic materials of life.

Nor is the space technology that began during the 1950's of the 20th century so far out of sight that we Chinese cannot consider it. According to statistics from relevant departments, since our successful launch of our first man-made satellite in 1970, we have launched 17 satellites over 16 years, 9 of which were launched during the "Sixth 5-year Plan." Aside from this, we successfully developed a transport rocket that can launch satellites into stationary orbits.

During the 5-year period, national defense scientific and technical achievements have also been glorious. Among the many prize winning projects, some made something from where we had nothing, which filled a vacuum in our military armaments; some reduced the gap between our military armament technology and world advanced levels, and some individual technologies have attained international advanced levels. New achievements in the national

defense science and technology front have already allowed our military armaments to enter world advanced ranks and allowed China to become one of the countries that control advanced technology for the development, launching, and testing of strategic nuclear weapons and earth synchronous fixed point satellites; we have become a country that can by itself research, design, and manufacture various kinds of weapons, such as fighter aircraft, tanks, and submarines.

During the period of the "Sixth 5-year Plan," scientific and technical workers were also very concerned with those questions closely related to the lives and safety of the people. For example, chorioepithelioma is a serious threat to the life and health of a pregnant woman, and after years of unceasing work by medical specialists we have found an effective method for a radical cure. Presently, the recovery rate from this kind of malignant tumor has risen from the 10.8 percent of the past to 89.9 percent. Specialists have found medicines for the treatment of acute non-lymphatic leukemia, the death rate for which is quite high. They have attracted the attention of international medical circles by artificial synthesis of the effective ingredient in the Hainan coarse torreya anti-cancer drug. Also, there is the "preparation to eliminate hemorrhoids" successfully developed under the direction of Chinese-Western medical theory, which is used often in clinics for treatment of hemmorrhoids in three visits, and is effective and safe.

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UPCOMING PLANS FOR S&T DEVELOPMENT DISCUSSED

Beijing LIAOWANG [OUTLOOK] in Chinese 3 Mar 86 pp 29-31

[Text] This is the first year of the "Seventh 5-year Plan." How will science and technology develop during the next 5 years in this country? In what fields will there be new breakthroughs? These are questions with which we are all concerned. To this end, we interviewed responsible persons concerned in science and technology sectors, as well as specialists who had participated in the drafting of the outline of plans for China's scientific and technical development during the "Seventh 5-year Plan." We asked them to tell us about the questions we have just asked.

In 5 Years We Will Catch Up At a Rate Equal to 10 Years

The 5 years of the "Seventh 5-year Plan" will be an extremely important 5 years for the course of China's scientific and technical advancement. Currently, a new scientific and technical revolution is flourishing on a world-wide scale. The appearance and development of electronic information technology, space technology, biologic technology, new materials technology, intelligent robots, and automation technology have led to the births of a series of rising new industries, which has also put a new face on traditional industries and technologies. There have also been great changes in commodity structures. Electronic information technologies and energy and materials technologies have already become three strong pillars for production forces in modern society.

In the face of the challenge from this new revolution in technology, the urgent mission for science and technology in China is to do all we can to catch up to world standards, reducing as quickly as possible the gap between China and economically developed countries. According to forecasts by specialists, the present scientific and technical standards in this country, and especially the standard of production technology, are roughly from 20 to 30 years behind those of economically developed countries. After 5 years of effort over the next 5 years we could expect to reduce that gap to from 10 to 20 years. That is to say that during the "Seventh 5-year Plan," China will strive to catch up to a level after 10 years in only 5 years time.

Development Strategies for Technology

To reduce the gap in technology with developed nations and to unite conditions in this country, how should development strategies for science and technology during the "Seventh 5-year Plan" be determined?

The "Seventh 5-year Plan" is a key 5 years in which to lay a foundation, and science and technology must both make positive contributions to economic development and also build up strength for development during the 10 years to follow. They must create the conditions in which the economy will take off. Because of this, the chief development strategies for technology are: to proceed from the actual conditions in this country and develop a compound model of technology that combines traditional technologies with rising new technologies. We must also transform existing professions and industries by means of the rising new technologies to allow a quicker shift to a basis of modern technology and modern management. As far as the development of rising new technologies is concerned, we must give preference according to the needs for development of the national economy and society in arranging for some strategic foci in agriculture, energy, transportation, and raw materials and for new technology regarding equipment. We must also give preference to the high technology fields of electronic information technologies, biologic technologies, and new materials. In extending and applying technology, we will invigorate the town and township economies.

In putting this strategy into effect, we must without any doubt continue to implement an open door policy, enhance international scientific and technical exchanges, import new technology, and pay close attention to intellectual development and continuing education to improve the quality and capacity of our scientific and technical contingent.

It is estimated that under the guidance of this kind of development strategy for technology, after the efforts of the "Seventh 5-year Plan" there will be a great improvement in the degree to which China's scientific and technical progress will accelerate economic development. While in regard to the acceleration of social development, science and technology will further improve the ecology and will raise people's living standards, nutritional standards, and the cultural and educational level of all our peoples.

Replacement of Principal Crop Varieties

Because of developments in breeding technology during the "Seventh 5-year Plan," by 1990 principal crop varieties in China can be expected to have been replaced. Highly resistant, excellent quality grain crops and new varieties of grain crops will greatly raise production quantities of agricultural crops and will increase the design and variety of commodities.

With the development of breeding technology and feed technology, the animal husbandry industry will provide for the market lean hogs with up to 60 percent lean meat and prime roaster chickens. It will not be as difficult for people to buy lean meat as it is today.

The technologies for rapid growing and high yield forests and afforestation technologies for arid and semi-arid regions will be the focus of scientific and technical research in forestry during the "Seventh 5-year Plan." Owing to the development of technologies for the comprehensive utilization of timber, the rate of utilization of leftover materials after felling and processing will be raised from the current 10 percent to about 30 percent.

There Will Be Breakthroughs in Atomic Energy

Energy technology is an important field in science and technology development plans during the "Seventh 5-year Plan." Regarding the coal industry, we will focus research on improving the state of open-pit and tunneling mechanization, will reduce the time to construct the pits, and will improve the standard of mechanization for coal extraction. From advances in research into the burning technology for inferior coal and technologies for the reasonable utilization of high-sulfur coal, by 1990 we will perhaps be able to replace tens of millions of tons of high quality coal with inferior quality coal.

During the "Seventh 5-year Plan," continental exploitation of petroleum might reach the technical standards abroad of the 1980's. New methods for oil prospecting, as well as developments in relevant new technologies and new equipment, will allow China to find even more oil.

In the area of electric power industries during the "Seventh 5-year Plan," in addition to continuing new developments in thermal power and hydroelectric technologies, there will also be breakthroughs in atomic power.

During the period of the "Seventh 5-year Plan," we will continue to implement the principles of "suiting measures to local conditions, the more capable supplementing the less capable, comprehensive utilization, and being particular about real results," and to study rural energy and new energies. Technologies to develop and construct energy forests, technologies to utilize bio-mass energy, as well as the utilization of solar energy, wind energy, ocean energy, and thermal energy, are all important areas for research.

Technology To Develop Comprehensive Transport

To enhance the delivery capacity of our transportation and shipping, during the "Seventh 5-year Plan," technical research into railway transport, highway transport, and air and space transport will be topics of national concern. Several targetted projects have been made part of the program of scientific and technical development during the "Seventh 5-year Plan" in, for one, the area of railway transport regarding entire technologies for exclusive coal transport lines using 10,000 ton cars and research into automated systems for railway operations; in highway shipping, development of road building technologies and new types of long distance passenger vehicles; in water transport, relevant technologies for port construction, and also the technology to manufacture civilian aircraft for air transport. Research into these topics will bring great developments in our comprehensive shipping technologies.

Respecting Scientific Research That Is Beneficial to Social Development

Science and technology will accelerate economic development, and science and technology will also promote the development of society. Science research in the areas of the environment and ecology, labor safety, medical and health care, and family planning occupy important positions in plans for scientific and technical development during the "Seventh 5-year Plan." Solving the scientific and technical problems of atmospheric and water pollution and studying technologies for the control of casualty incidents and technologies for the control of dust threats are important topics for environmental protection and labor safety. The major areas of study for medical science and technology will be research into the prevention of cancer, viral hepatitis, coronary and cerebral vascular and major and local diseases, and blood flukes; putting in order the ancient documents of Chinese medicine and pharmacology, use of modern scientific and technical methods to study improvement of the level at which Chinese medicine prevents and treats disease, and establishment of a unique Chinese system of pharmacological theory.

Research into birth control technical mechanisms and birth control drugs, as well as studies into eugenics and the raising of children will provide scientific and technical assurances for effective population control.

Implementing "Spark Plans"

The development of local and town and township enterprises is where our hopes lie for the full scale prosperity of our national economy. In recent years town and township enterprises have developed quite quickly, but problems that exist everywhere are that our technology is backward and that we seriously lack technical capacity and technical equipment. During the "Seventh 5-year Plan," we will train for town and township enterprises 1 million people as technical personnel and as operations and management personnel; we will develop 100 kinds of production equipment lines suited to the needs of town and township enterprises; and we will pay close attention to 500 town and township industrial demonstration sites that are valuable for dissemination and application.

The fundamental points of the "spark plans" as approved by the Party Central Committee and the State Council are: to rely on advances in science and technology, to accelerate variable operations and comprehensive utilization, to allow the healthy development of town and township enterprises, to change rural economic structures, and to promote the full scale construction of small cities and towns; to accelerate the development of a commodity economy, to allow production to be put into factories and intensified, and to establish joint bodies that are unifications of trade, technology, industry, and agriculture to increase the number of export products, to increase the number of consumer products for the people, and to promote town and township economic prosperity.

Greatly Enhance Basic Research

The focus of basic science research will be on topics with a prospect as applications, and especially on basic research that caters to the characteristics of China's natural conditions and natural resources. But close attention will also be paid to basic research that has major scientific significance. In aspects of basic research, major research projects include 43 special topics in the seven areas of mathematical sciences, chemistry, biological sciences, earth sciences, engineering sciences, and the soft sciences.

One is Restructuring, Two is Talent

The mission of the development of science and technology is an arduous one, and very difficult. To accomplish these tasks, we will on the one hand restructure, and on the other depend on talent.

The goals of restructuring are to be beneficial to effecting the commercialization of scientific and technical accomplishments and the marketing of scientific and technical commodities; to be beneficial to arousing and making the most of young and middle-aged key scientists and technicians; to be beneficial to enhancing the capacity for scientific and technical development of enterprises, as well as to make full use of economic levers.

Regarding the training of talent, we must base ourselves on the requirements of the national economy, society, and scientific and technical development as we open up paths of study and train specialized talent at the middle and higher levels, entry level technicians, and skilled workers. At the same time, we want to focus on training scientific and technical management personnel. For those scientists and technicians currently employed, we will undertake continuing education at intervals and in groups to acquire new knowledge and improve quality.

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WIND, KUROSHIO SYSTEM ACTION ON EAST CHINA SEA CIRCULATION

Beijing HAIYANG KEXUE [MARINE SCIENCES] in Chinese Vol 9 No 3, 9 May 85 pp 1-4

[Article by Liu Fengshu [0491 7364 2885], Institute of Oceanology, Chinese Academy of Sciences: "Action of Wind Stress and Kuroshio System on the Circulation in the East China Sea*"]

[Text] English abstract: The circulation in the East China Sea is described by using the balance equation of wind stress curl and lateral stress curl. Analysis shows that the Kuroshio system plays a determinant role and the wind stress only acts as an adjustment factor in generation of the circulation.

Based on the floor friction stress curl, planetary curl and wind stress curl balance equation, we studied (Liu Fengshu, et al., 1984) the possible contributing factors of the circulation in the East China Sea under the action of the Kuroshio (boundary forces (Xi Pangen [1153 4149 2704] et al., 1980; Feng Shize [7458 1102 4575] et al., 1981)) in changing ocean floor topography. We pointed out that the formations of East China Sea circulation were primarily the result of Kuroshio action with the wind effect only playing a regulatory role. This paper studies, again on the basis of the lateral stress curl equation, the action of wind stress and the Kuroshio on formation of East China Sea circulation.

I. Model

Assuming that the ocean area being investigated is an even depth barotropic sea, overlooking nonlinearity and floor friction, the full flow equation under constant motion is

$$A_1 \nabla^2 q_x + \frac{\tau_x}{\rho} + f q_y = g h \frac{\partial \zeta}{\partial x} \tag{1}$$

$$A_1 \nabla^2 q_y + \frac{\tau_y}{\rho} - f q_x = g h \frac{\partial \zeta}{\partial y} \tag{2}$$

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* Chinese Academy of Sciences, Institute of Oceanology, Survey Research Report No 1155. Comrade Yu Kejun [0060 0344 0193] helped with this report and here we give him special thanks.

$$xps\int_{\psi}^{o} = {}^{s}b \quad xp\ n\int_{\psi}^{o} = {}^{z}b$$

$$0 = \frac{\hbar\varrho}{{}^{s}b\varrho} + \frac{x\varrho}{{}^{z}b\varrho} \tag{3}$$

Here, q_x, q_y, and τ_x, τ_y are, respectively, the full flow component and the wind stress component on axes x and y; ξ is the water level; f is the Coriolis [ke shi 4430 3044] parameter; g is gravitational acceleration; A_1 is the horizontal viscosity coefficient; ρ is the sea water density; h is the water depth; ∇^2 is the Laplace operator.

1. Wind Stress Effect

We cross integrate Equations (1) and (2) and introduce the full flow function:

$$q_x = -\frac{\partial\psi}{\partial y} \quad q_y = \frac{\partial\psi}{\partial x} \tag{4}$$

then the lateral curl and wind stress curl balance equation is:

$$\nabla^2\psi = -\frac{1}{A_1} rot_z \tau \tag{5}$$

Assuming that the East China Sea is something like a fan-shaped sea area, in the polar coordinate system, we take the angle θ and go clockwise due north to south. We carry out coordinate transformation:

$$r = r_1 e^{\xi} \qquad \theta = \theta \tag{6}$$

then the Equation (5) becomes:

$$\left(\frac{\partial^2}{\partial\xi^2} + \frac{\partial^2}{\partial\theta^2}\right)^2 \psi = -\frac{r_1 e^{\xi}}{A_1} rot_z \tau(\xi,\theta). \tag{7}$$

Equation (7) satisfies the free boundary condition of exchange of water volume at the water boundary when the shore boundary full flow is zero:

$$\psi\Big|_{\xi=0} = 0, \quad \frac{\partial\psi}{\partial\xi}\Big|_{\xi=0} = 0,$$

$$\psi\Big|_{\xi=\beta=0} = 0, \quad \frac{\partial\psi}{\partial\xi}\Big|_{\xi=\beta=0} = 0,$$

$$(0 \leqslant \theta \leqslant \theta_2)$$

$$\frac{\partial\psi}{\partial\xi}\Big|_{\xi=\beta=0} = 0, \quad \frac{\partial^3\psi}{\partial\xi^3}\Big|_{\xi=\beta=0} = 0,$$

$$(\theta_2 \leqslant \theta \leqslant \theta_1)$$

$$\psi\Big|_{\theta=0} = 0, \quad \frac{\partial^2\psi}{\partial\theta^2}\Big|_{\theta=0} = 0,$$

$$\frac{\partial\psi}{\partial\theta}\Big|_{\theta=\theta_1} = 0, \quad \frac{\partial^3\psi}{\partial\theta^3}\Big|_{\theta=\theta_1} = 0 \tag{8}$$

Using limited Fourier conversion to solve Equation (7) satisfies the solution of boundary condition (8):

$$\widetilde{\psi} = \int_0^{\theta_1} \psi \sin \lambda_n \theta d\theta$$

$$\psi = \frac{2}{\theta_1} \sum_{n=1}^{\infty} \widetilde{\psi} \sin \lambda_n \theta \tag{9}$$

$$\lambda_n = (n - 1/2) \frac{\pi}{\theta_1} \tag{10}$$

Substituting in Equation (7) we get:

$$\frac{d^4 \widetilde{\psi}}{d\xi^4} - 2\lambda_n^2 \frac{d^2 \widetilde{\psi}}{d\xi^2} + \lambda_n^4 \widetilde{\psi} = -2 \frac{r_1 e^{4\xi}}{A_1 \lambda_n} \tau_{r\theta} \tag{11}$$

Here $r\theta_1 \tau \approx 2\tau_{r\theta}$

Let: $$\left(\frac{d}{d\xi} - \lambda_n\right)\widetilde{\psi} = \eta \tag{12}$$

Equation (12) satisfies the boundary condition:

the solution of $\widetilde{\psi}\Big|_{\xi=0} = 0, \quad \frac{\partial \widetilde{\psi}}{\partial \xi}\Big|_{\xi=0} = 0$

is $$\widetilde{\psi} = \int_0^{\xi} \eta \, sh\lambda_n (\xi - \xi_1) d\xi_1 \tag{13}$$

Substituting (13) in Equation (11) we get

$$\eta = Ae^{\lambda_n \xi} + Be^{-\lambda_n \xi} - F\left\{ \lambda_n e^{4\xi} - \frac{1}{2}(4 + \lambda_n) e^{\lambda_n \xi} + \frac{1}{2}(4 - \lambda_n) e^{-\lambda_n \xi} \right\} \quad F = \frac{2\tau_{r\theta} r_1}{A_1 \lambda_n^2 (16 - \lambda_n^2)} \tag{14}$$

Substituting Equation (14) in Equation (13) we get the solution:

$$\widetilde{\psi} = A\Phi_1(\xi) + B\Phi_2(\xi) - F_1(\xi)$$

$$\Phi_1(\xi) = \xi e^{\lambda_n \xi} - \frac{1}{\lambda_n} sh\lambda_n \xi$$

$$\Phi_2(\xi) = \frac{1}{\lambda_n} sh\lambda_n \xi - \xi e^{-\lambda_n \xi}$$

$$F_1(\xi) = F(\lambda_n e^{4\xi} - 4sh\lambda_n \xi - \lambda_n ch\lambda_n \xi) \frac{1}{16 - \lambda_n^2} \tag{15}$$

On the basis of boundary condition (8) we can find coefficients A and B.

(1) In the interval $0 \leqslant \theta \leqslant \theta_2$ $(\theta^2 = 35°)$

$$D = \begin{vmatrix} \Phi_1(\beta) & \Phi_2(\beta) \\ \Phi_1'(\beta) & \Phi_2'(\beta) \end{vmatrix}$$

$$AD = \begin{vmatrix} F_1 & \Phi_2(\beta) \\ F_1' & \Phi_2'(\beta) \end{vmatrix}$$

$$BD = \begin{vmatrix} \Phi_1(\beta) & F_1 \\ \Phi_1'(\beta) & F_1' \end{vmatrix}$$

(2) In the interval $\theta^2 \leqslant \theta \leqslant \theta^1$ $(\theta^1 = 70°)$

$$D = \begin{vmatrix} \Phi_1'(\beta) & \Phi_1'(\beta) \\ \Phi_1''(\beta) & \Phi_1''(\beta) \end{vmatrix}$$

$$AD = \begin{vmatrix} F_1' & \Phi_1'(\beta) \\ F_1'' & \Phi_1''(\beta) \end{vmatrix}$$

$$BD = \begin{vmatrix} \Phi_1'(\beta) & F_1' \\ \Phi_1''(\beta) & F_1'' \end{vmatrix}$$

$$(\Phi_{1,2}', \Phi_{1,2}'') = \left(\frac{d\Phi_{1,2}}{dt}, \frac{d^3\Phi_{1,2}}{dt^3}\right)_{t=\beta}$$

$$(F_1', F_1'') = \left(\frac{dF_1}{dt}, \frac{d^3F_1}{dt^3}\right)_{t=\beta}$$

Substituting Equation (15) in Equation (10), we obtain a circulation model of the sea area pattern caused by wind stress curl.

$$\psi = \frac{2}{\theta_1} \sum_{n=1}^{M} \left\{ A\Phi_1(t) + B\Phi_2(t) - F_1 \right\} \times \sin\lambda_n\theta + \frac{4}{\theta_1} \sum_{n=M+1}^{\infty} \frac{\tau_0 \left| \tau = \theta \right.}{A_1 \lambda_n^5} e^{\lambda_n t} \sin\lambda_n\theta \qquad (16)$$

2. Kuroshio Effect

Without any wind stress action ($\tau_r = \tau_\theta = 0$), Equation (11) changes to:

$$\left(\frac{\partial^2}{\partial t^2} + \frac{\partial^2}{\partial\theta^2}\right)^2 \psi = 0 \qquad (17)$$

This action is only produced under action of boundary value $|\Psi_r|$. It satisfies the following boundary conditions.

$$\psi\Big|_{\xi=0} = 0, \quad \frac{\partial\psi}{\partial\xi}\Big|_{\xi=0} = 0$$

$$\psi\Big|_{\xi=\beta} = \begin{cases} 0 & \theta < \theta_2, \\ \psi_r \mid & \theta > \theta_2, \end{cases}$$

$$\frac{\partial\psi}{\partial\xi}\Big|_{\xi=\beta} = 0,$$

$$\psi\Big|_{\theta=0} = 0, \quad \frac{\partial^2\psi}{\partial\theta^2}\Big|_{\theta=0} = 0,$$

$$\frac{\partial\psi}{\partial\theta}\Big|_{\theta=\theta_1} = 0, \quad \frac{\partial^3\psi}{\partial\theta^3}\Big|_{\theta=\theta_1} = 0$$

For a function to cause the boundary condition to become homogeneous, let:

$$\psi = \psi_0 + \psi_1 \tag{19}$$

$$\psi_1 = \left(\frac{4}{\beta^3} - \frac{3\xi}{\beta^4}\right)\xi^3\psi\Big|_{\xi=\beta} \tag{20}$$

Substituting Equation (19) in Equation (17) we get:

$$\left(\frac{\partial^2}{\partial\xi^2} + \frac{\partial^2}{\partial\theta^2}\right)^2 \psi_0 = \frac{72}{\beta^4}\psi\Big|_{\xi=\beta} \tag{21}$$

The solution of Equation (21) is the same as earlier, we get:

$$\tilde{\psi}_0 = A_0\Phi_1(\xi) + B_0\Phi_2(\xi) + \frac{\Gamma}{\lambda_n^2}(1 - ch\lambda_n\xi)$$

$$\Gamma = -\frac{72}{\beta^4}\Big|\ \psi_r\ \Big|\cos\lambda_n\theta_2 \tag{22}$$

The form of expression of $\Phi_1(\xi)$ and $\Phi_2(\xi)$ is the same as before. The coefficients A_0 and B_0 are given by boundary condition (18):

$$D_0 = \begin{vmatrix} \Phi_1(\beta) & \Phi_2(\beta) \\ \Phi_1'(\beta) & \Phi_2'(\beta) \end{vmatrix}$$

$$A_0D_0 = \begin{vmatrix} \frac{\Gamma}{\lambda_n^2}\left(ch\lambda_n\beta - 1\right)\Phi_2(\beta) & \\ \frac{\Gamma}{\lambda_n^2}sh\lambda_n\beta & \Phi_2'(\beta) \end{vmatrix}$$

$$B_0D_0 = \begin{vmatrix} \Phi_1(\beta) & \frac{\Gamma}{\lambda_n^2}\left(ch\lambda_n\beta - 1\right) \\ \Phi_1'(\beta) & \frac{\Gamma}{\lambda_n^2}sh\lambda_n\beta \end{vmatrix}$$

From this we get the circulation model of the model sea area caused by action of boundary $|\Psi_r|$ as follows:

$$\psi = \left(\frac{4}{\beta^3} - \frac{3\xi}{\beta^4}\right)\xi^3\psi\Big|_{\xi=\beta} + \frac{2}{\theta_2}\sum_{n=1}^{M}\left\{A_0\Phi_1(\xi) + B_0\Phi_2(\xi)\right.$$

$$\left. + \frac{\Gamma}{\lambda_n^3}(1 - ch\lambda_n\xi)\right\}\sin\lambda_n\theta + \frac{2}{\theta_1}\sum_{n=M+1}^{\infty}\frac{72}{\beta^4\lambda_n^5} \times \left|\Psi_r\right|\cos\lambda_n\theta_2\sin\lambda_n\theta \qquad (23)$$

II. Computed Results

Using the following parameters we computed the wind-produced circulation pattern (16) and the circulation caused by the boundary value action (23). $r_1 = 8.5 \times 10^7$cm, $A_I = 10^6$cm^2/s, $\theta_2 = 35°$, $\theta_1 = 70°$, $|\Psi_r| = 30 \times 10^{12}$cm^3/s, winter $\tau_{m\theta} = 2.04$ g/cms^2, summer $\tau_{m\theta} = -0.4$ g/cms^2, $\xi = 0.56$.

1. Wind-produced Circulation

From Figure 1 it can be seen that one branch of the current follows the eastern boundary of the sea area and flows into the Yellow Sea through Jizhou Island and the Korean peninsula, then flows south along the western boundary of the sea area and enters the South China Sea through the Taiwan Straits; the other branch flows to the southwest and at 124°E off Hangzhou Bay it reassembles and flows south along the coast. The strength of this branch is approximately two magnitudes greater than the former ($\Psi \sim 10^{12}$cm^3/s).

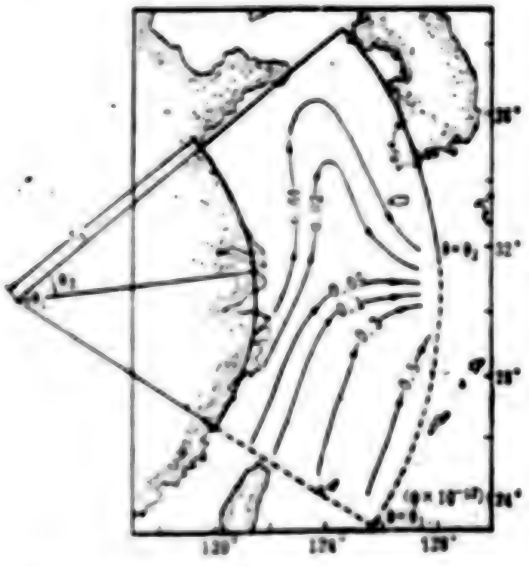

Figure 1. Winter (January) Wind-Produced Circulation (Computed Values)

----coastal border; ....marine border

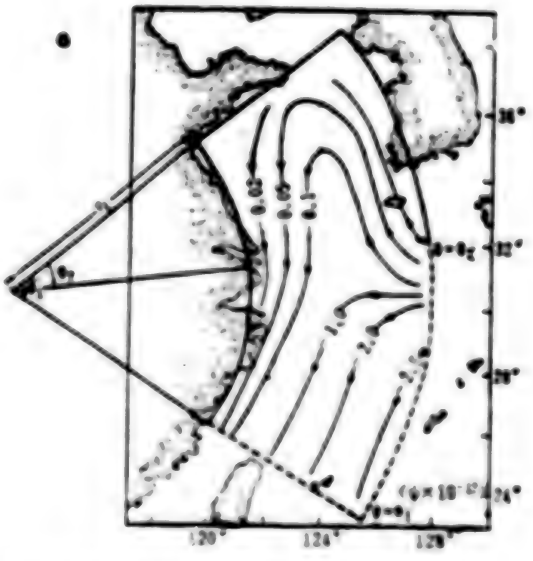

Figure 2. Summer (July) Wind-Produced Circulation (Computed Values)

----coastal border; ....marine border

In the summer (July) the flow field distribution of the entire sea area observed tends to be the opposite of the winter (see Figure 2), but its volume is one magnitude smaller than the winter ($\sim 10^{11}cm^3/s$).

If we compare these results with the numerical research results of Byung Hochoi (1982) based on the nonlinear liquid dynamic model, it can be seen that in the winter the flow field distribution under the north wind (N) action fits; in the summer, the flow field distribution is identical under the southwest wind (SW) action.

2. Circulation Caused by Kuroshio

Assuming the flow of the Kuroshio in winter and summer does not change, the results of computing Equation (23) shows that in the Yellow Sea region north of 30°N there is a counterclockwise sea flow area, with its center near 34°N, 124°E, with a maximum value at the center of $|\psi| 2.5 \times 10^{12} cm^3/s$. In the East China Sea there is a general flow from the Taiwan Straits and East China Sea region (the Kuroshio region) towards the northeast, the velocity increases from the seacoast out to sea and in the vicinity of 31°N converges. This fits with the Kuroshio flow axis (Figure 3).

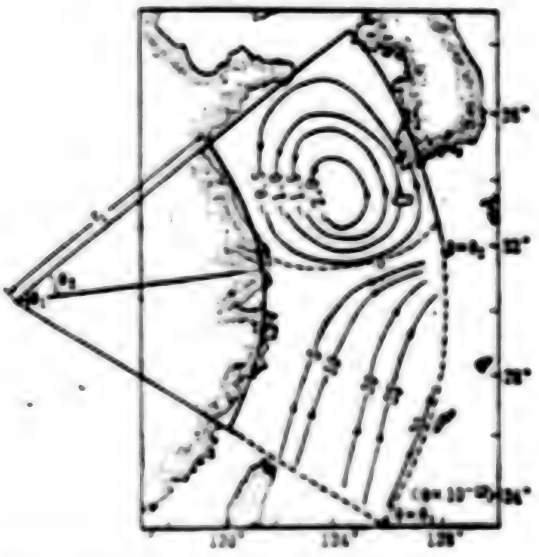

Figure 3. Circulation Caused by Kuroshio (Computed Values)
----coastal border; ...marine border

The flow function of wind-produced circulation is smaller than that caused by the Kuroshio by a magnitude of 1-2. It is clear that the wind only plays a regulatory role in its influence on circulation.

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HIGH RESOLUTION SEA SURFACE TEMPERATURE FIELD DERIVED

Beijing HAIYANG KEXUE [MARINE SCIENCES] in Chinese Vol 9 No 3, 9 May 85 pp 5-9

[Article by Zhou Sisong [0719 0843 2646], Chen Weiying [7115 4850 5391], and Zhang Lixia [1728 7787 7209], Satellite Meteorological Center, State Meteorological Administration: "A High Resolution Sea Surface Temperature Field Derived From AVHRR Infrared Window Radiation Measurements"]

[Text] English abstract: A procedure for deriving high resolution sea surface temperature field from digital AVHRR/HRPT data is described in this paper. For the purpose of reducing the processing time, only the reflectivity threshold or near infrared channel is used for selecting data over clear area of ocean, and W.L. Smith single window channel sea surface temperature retrieval method is used for atmospheric attenuation correction for the area of Beihai Bay and Yellow Sea during the cold half of the year. Comparing with other measurement the result is quite satisfactory.

In recent years, exploitation and use of marine resources have placed increasingly high demands on marine environmental services. The marine observations and surveys now carried out by conventional means are frequently limited to an extremely narrow sea area due to high costs or limitations of conditions and are very discontinuous in terms of time. Therefore, it is very difficult for conventional observation and survey methods to satisfy the daily increasing demands for marine environmental services.

The development of satellite remote sensing technology and progress in satellite data processing methods have provided us with new ways to obtain information on the marine environment. This paper introduces a comparatively simple and effective method of using the TIROS-N satellite direct readout station to receive daytime AVHRR/HRPT (Advanced Very High Resolution Radiometer/High Resolution Pattern Transmission) data to compute surface temperature. The advantage of this method is that calculations are rapid, no conventional data is required, and a very high resolution sea surface temperature field is provided. The entire processing process is completely automated.

I. TIROS-N Series Satellites and AVHRR Data

The U.S. National Oceanographic and Atmospheric Administration's (NOAA) third generation service polar-orbiting environmental satellites, the TIROS-N series satellites were first launched in October 1978 and put into operation

in November of that year. The satellite is in an elliptical solar-synchronous orbit at an altitude of approximately 850 km, has an orbiting cycle of 102 minutes and circles the earth 14 times a day. Each day the entire globe is observed twice due to the earth's rotation and the detector's lateral scanning perpendicular to the satellite's forward direction. The ones currently in operation are NOAA-7 and NOAA-8 in this series.

The AVHRR is one of the primary instruments used in meteorological and ocean parameter measurement. This is a 4 or 5 spectral channel visible light infrared waveband scanning radiometer. See Table 1 for the 4 or 5 channel AVHRR spectral wave band. The instrument's instantaneous optical field is 1.4 milliradians, the spatial resolution of the point below the satellite is 1.1 km. The AVHRR data sent in realtime by the TIROS-N series satellite's HRPT channel is digital information of the original resolution in coded form. At the same time, the information flow contains remote measurement information used for earth observation data markers and material quality testing for quantitative processing of the materials.[1]

Table 1. 4 or 5 Channel AVHRR Spectral Waveband

Channel number	Spectral waveband	
	4 channel AVHRR	5 channel AVHRR
1	0.58 - 0.68 μm	0.58 - 0.68 μm
2	0.73 - 1.10 μm	0.73 - 1.10 μm
3	3.55 - 3.93 μm	3.55 - 3.93 μm
4	10.50 - 11.50 μm	11.50 - 11.30 μm
5		11.50 - 12.50 μm

II. Basic Principles of Infrared Window Radiation Measurement of Sea Surface Temperature Inversion

What the radiometer on the satellite measures is the radiation radiated from things on the ground. Because an atmospheric "window area" waveband is used and not a true window, the radiation given off by the sea surface is still influenced by various absorption elements in the atmosphere. There are two influences of the atmosphere on the radiation received by the radiometer. One is the decay of radiation given off by the sea surface by various absorption elements in the atmosphere e transmission process; these absorption gases are primarily water vapo on dioxide, nitrogen, and methane, among which water vapor absorption is the strongest, and its content clearly varies with latitude, region, and seasons, and is the primary factor influencing the satellite radiation's precision in measuring sea surface temperature inversion. The second is that absorption gases also radiate towards space and increase the radiation received by the radiometer. Expressing the basic principle of infrared window radiation measurement of sea surface temperature inversion in mathematical form, the radiation transmission equation[2] is:

$$N(\nu) = B(T_s, \nu) \cdot \tau(P_s, \nu) - \int_1^{\tau(P_s, \nu)} B(T_p, \nu) \cdot d\tau(P, \nu) \quad (1)$$

Equation (1) is when the sea surface is viewed as a black body, (the sea surface emissivity of the chosen waveband is 1). In the equation, $N(\nu)$ is the radiance received by the radiometer on the satellite, Ts is the sea surface temperature, T_p is the atmospheric layer temperature of a place P equivalent to the air pressure value, $\tau(P,\nu)$ is the penetrability between the satellite and the atmospheric layers (or ground surfaces), ν is the number of waves, $B(T,\nu)$ is the Planck function, whose value is

$$B(T,\nu) = \frac{2hc^2\nu^3}{e^{\frac{hc\nu}{kT}} - 1} \quad (2)$$

in which h, c, and k are the Planck constant, speed of light and Balzaman constant.

If we know the vertical distribution of atmospheric temperature and humidity, and the other influences which absorb sea surface emission radiation, we can calculate $B(Tp,\nu)$ and $\tau(P, \nu)$ and then calculate sea surface temperature Ts.[2] However, the number of ships which now check the atmosphere at sea on a daily basis is very few; in many areas the atmospheric soundings are still blank and it is difficult to obtain vertical distribution materials on the atmospheric temperature and humidity at sea. Except for individual research situations, the above method is generally not employed for computing sea surface temperature.

The presence of clouds also influences the satellite's sea surface temperature inversion materials. When the radiometer's immediate optical viewing field is covered by clouds, what is received is radiation emitted from the cloud tops; when the radiometer's optical viewing field is partially covered by clouds, what is received is the sum total of radiation emitted from the sea surface and the cloud tops. For the satellite radiation measurement to reflect sea surface temperature accurately, it is necessary to carry out atmospheric correction and correctly select clear air sea surface observation data (or eliminate observation data influenced by clouds). Research work at home and abroad provides some experience for solving the above problems, and some well-developed methods have been used for sea surface temperature calculations. (Footnote 1) (Zhou Sisong [0719 0843 2646], "Cloud Detection and Atmospheric Weakening Correction in Satellite Radiation Measurement Sea Surface Temperature Inversion," HAIYANG YUBAO FUWU [MARINE FORECAST SERVICE] (forthcoming))

III. Calculation Process

AVHRR channel 2 and channel 4 data were used in the calculations, in which channel 2 was used for cloud detection and distinguishing land/marine observation data; channel 4 was used for sea surface temperature inversion.

Before carrying out cloud detection and atmospheric correction, data from channels 2 and 4 were converted from encoded counting values to albedos and radiances received by the radiometer on the satellite, and using Planck's equation the radiances of channel 4 were converted into equivalent black body temperatures (or brightness temperatures) (Footnote 2) (Zhou Sisong, 1984, "Using AVHRR Data Received by TIROS-N Satellite Direct Readout Station To Calculate Radiation Revenue of Partial Region," QIXIANG KEJI [METEOROLOGICAL SCIENCE AND TECHNOLOGY], 3) on the emitting surface for further processing.

1. Selection of Clear Air Sea Surface Observation Data

Since the radiance of sea (water) surface for near-infrared wave band is generally lower than 4 percent, as space changes, it is also extremely slow (see Figure 1), land (including vegetation), frozen sea surface or cloud top radiance are clearly higher than this value. When using daytime AVHRR data to calculate sea surface temperatures, using this characteristic, it is very easy to select the clear-air sea (water) surface observation data. The channel 2 radiance threshold value used in the calculations was 3 percent. If the radiance of the observed point on channel 2 was below the threshold value, the channel 4 data of the corresponding point was regarded as clear-air sea surface observation data. The formula for distinguishing them is:

$$A_1 \overset{?}{\leqslant} A_t \tag{3}$$

in which A_t is the radiance threshold of AVHRR channel 2, and A_1 is the channel 4 radiance value of the observed point.

If night-time AVHRR data was used in the calculations, a rather complex cloud detection method should be used. (Footnote 3) (E.P. McClain, et al., "Multichannel Improvements to Satellite-Derived Global Sea Surface Temperatures" Preparing XXII COSPAR, Ottawa, Canada, 22-29 May 1982)

2. Atmospheric Correction

Because the atmosphere over the Bohai and the Yellow Sea is relatively dry in the winter time, to simplify calculations, we directly followed W.L. Smith's single channel sea surface inversion atmosphere correction model.[3] Comparing this method with the results of many days calculations of multi-channel sea surface temperature inversion algorithm (Footnote 4) (Ibid.) the two are very close. The atmospheric correction equation of W.L. Smith's method is:

$$T_s = T_B + \Delta T \tag{4}$$

in which T_s is the sea surface temperature desired, T_B is the brightness temperature of channel 4, and ΔT is the atmospheric correction, whose value is:

$$\Delta T = \left[a_0 + a_1\left(\frac{\theta}{60}\right)^{a_2}\right] \times \ln\left(\frac{100}{310 - T_B}\right) \quad (210^\circ < T_B < 300^\circ k,\ \theta \leqslant 60^\circ) \tag{5}$$

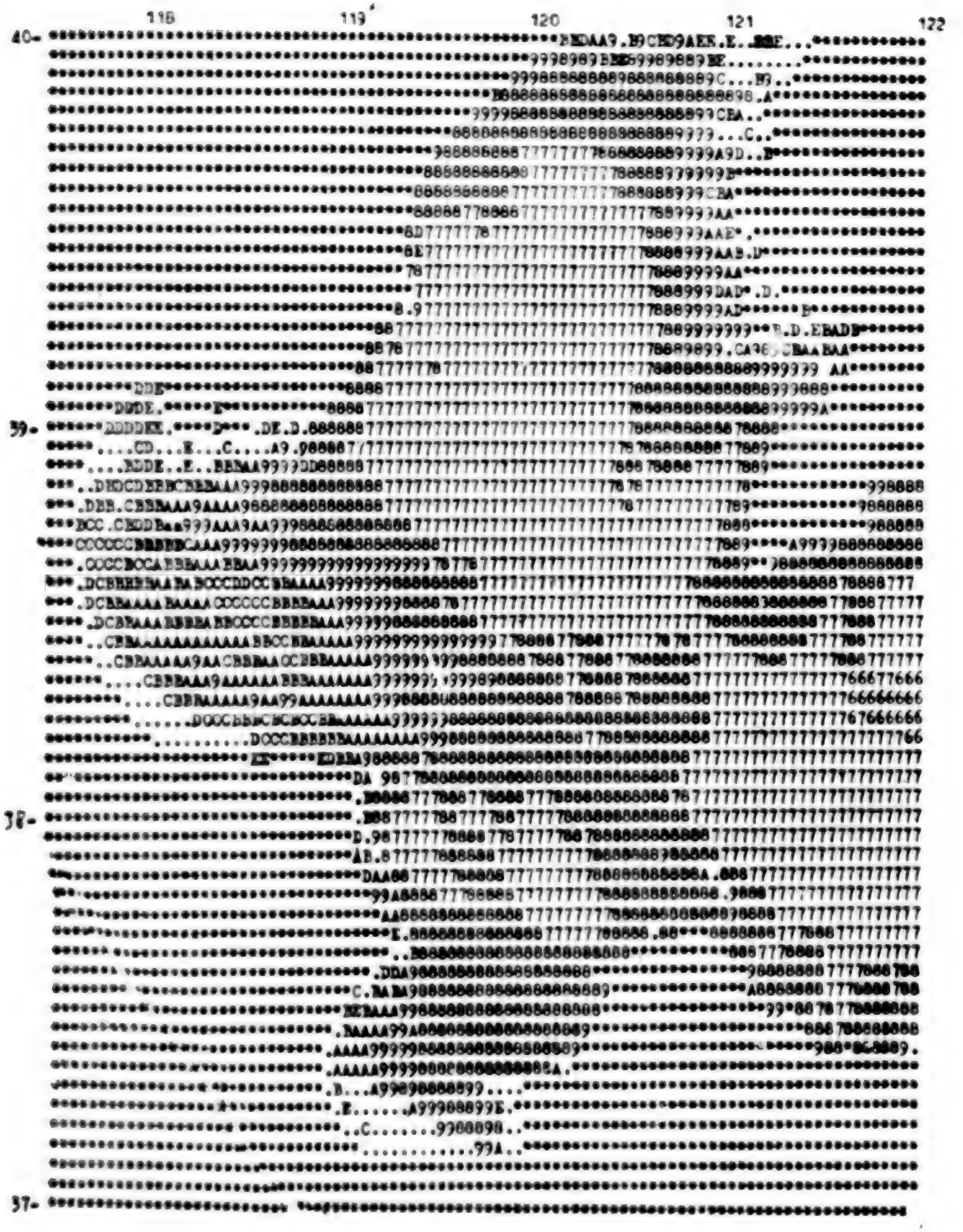

Figure 1. Sea Surface AVHRR Channel 2 Albedo (18 February 1984; values have been magnified 5-fold, i.e., in the figure 1-F represents successively reflectivity of 0.2-2.8 percent)

Figure 2. 5-km Resolution Satellite Sea Surface Temperature Field (Partial) (18 February 1984)

in which a_0, a_1, and a_2 are regression coefficients, whose values are, respectively: $a_0 = 1.13$, $a_1 = 0.82$, $a_2 = 2.48$; θ is the satellite zenith angle.

3. Conversion of Output Format

To obtain a high resolution sea surface temperature field without making the output results too large, we used the character printer output method, i.e., we converted the calculation results at the selected grid points into integers using the rounding off method, and then used different characters to

represent different temperatures, establishing a correspondence between characters and temperatures. The printed results covered a 10° x 10° latitude/longitude range, with the 101 x 101 or 201 x 201 character output resolution being a sea surface temperature field of 10 km or 5 km, respectively.

IV. Calculation Results and Analysis

Figure 2 is a 5 km resolution sea surface temperature field calculated from AVHRR data of 15:00 hours (Beijing time) 18 February 1984. From Figure 2 it can be seen that the 5 km resolution sea surface temperature field can more clearly show the distribution and direction of cold and warm sea currents.

To check the reliability of clear-air sea surface observation data, we compared the calculation results with the satellite photographs. The results showed that the ice cover of the coastal water areas of a large part of Liaodong Bay, the southern and northern portions of the Bohai Bay and the western and southern portions of Laizhou Bay was eliminated, and that a large area of clouds in the central and southern parts of the Yellow Sea was also eliminated. To verify the precision of the satellite sea surface temperature, the calculation results were compared with the on-the-spot survey materials (Table 2) of an icebreaker from 14-16 February. Since the survey points were mostly in the coastal sea region, the overwhelming majority were negative values; but in our output results, when the temperature was lower than 0.5°C, it was represented as blank space and no specific temperatures were given, so it was difficult to compare the two. However, in areas in the vicinity of the Bohai Straits where the water temperature is higher, the two are very close with a difference between 0.5°C and 10°C.

In addition, we also compared the calculation results with the 10-day average sea surface temperature map issued by the Japan Meteorological Office for February and found that the two were very close in numerical values and distribution trends.

Table 2. Icebreaker Water Temperature Measurements* (14-18 February 1984)

Day	Latitude	Longitude	Water surface temperature (°C)
14	38°28'	120°45'	3.1
14	38°15'	120°34'	2.0
14	37°58'	120°22'	-0.7
15	37°41'	120°09'	-0.7
15	37°28'	119°30'	-1.1
15	37°44'	119°17'	-1.0
16	38°41'	119°29'	-1.6
16	38°16'	118°31'	-1.7
16	38°40'	118°07'	-1.1
16	38°54'	117°59'	-1.6

*Icebreaker observation data provided by Comrade Tong Mingyuan [0157 2494 6678]

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NEW MODEL He-Ne LASER TUBES TESTED

Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese Vol 13 No 4, Jul 85 pp 50-56

[Article by Wang Yuzhi [3769 2948 4249] and Huang Zonglin [7806 1350 2651], Chengdu Institute of Radio Engineering: "Mechanism of Ignition Voltage Lowering in a New Model He-Ne Laser"]

[Text] ABSTRACT. Three specially fabricated tubes (ordinary type, modification 1, modification 2) and seven different gases (He, Ne, He-Ne mixture, Ar, Kr, H_2, N_2) were used in experimental studies of the mechanism by which the ignition voltage is lowered in a new model He-Ne laser tube invented by the Tianjin Laser Research Institute. The experiments showed that the modified versions had lower ignition voltages, but only in a certain pressure range, and that as the pressure rose to some value P_0, which depended on the type of gas, the size of the ignition voltage decrease approached zero. A theoretical explanation of the experimental results is given.

Since the Tianjin Laser Research Institute invented a low-ignition-voltage He-Ne gas laser, various different mechanisms for the decrease in its ignition voltage have been suggested [1-6]. The present writers fabricated three sample He-Ne tubes, made measurements with various gases, and made a preliminary analysis and interpretation of the measurements.

I. Experimental Apparatus and Measurement Results

The three types of laser tubes used, (ordinary type, modification 1, modification 2) differed in the shape and position of their glass baffles. Their other dimensions were the same (Fig. 1): cavity length 280 mm, electrode spacing 210 mm, capillary tube diameter 1.2 mm. The measurement circuit had a current-limiting resistance of 720 kΩ. A model 5301 expansion system [6] was used to measure the pressures of He, Ne, a He-Ne mixture (8:1), Ar, Kr, H_2 and N_2 at pressures between 10^{-1} and 20 torr. The results are shown in Table 2.

It can be seen that: (1) the decrease in the ignition voltage was smaller for modification 1 than for modification 2; (2) the lowering of the ignition voltage occurred only in a certain pressure range, and disappeared when the pressure reached some value P_0; (3) the pressure range in which the ignition voltage was decreased depended on the type of gas. Table 1 shows the values of P_0 for the various gases used.

It can be seen from the table that the values of P_0 for the inert gases fell into the order $P_{0He} > P_{0Ne} > P_{0Ar} > P_{0Kr}$, and that the values for the molecular gases H_2 and N_2 were lower than those for the inert gases (except for krypton).

II. Analysis and Interpretation of Experimental Results

Most He-Ne lasers use capillary-tube discharges, and accordingly must be explained in terms of these discharges. Naturally, an increase in the number of electrons also requires a γ-process; this too is an important factor.

The capillary tubes used in the He-Ne lasers differed somewhat from those described in Ref. 7: they did not contain the cathodes or anodes, so that after ignition the positive column was inside the tube, while the cathode voltage drop region, which is critical to discharge maintenance, was outside it. But because we are studying only the ignition process, which belongs to the avalanche buildup stage before a glow discharge is formed, the theoretical approach presented in Ref. 7 obviously is still applicable to ignition of an He-Ne laser.

According to Ref. 7, in the interval $x \rightarrow \Delta x$ the increase in the numerical electron density n_e is

$$\frac{dn_e}{dx} = \alpha n_e - W n_e \qquad (1)$$

where α is the first Townsend ionization constant and W is the decrease in the number of electrons per centimeter of path length between the cathode and anode as a result of recombination on the walls. Thus the number of avalanche propagations is determined by α, the ionization number per unit path length, and by W, the number of recombinations with the walls per unit path length.

Wall recombination during the ignition process cannot be regarded as a process of bipolar diffusion of a plasma toward the tube walls, because a plasma column has not yet appeared and the condition $n_i \approx n_e$ is unsatisfied everywhere in space. Actually, at this time the electron number increases rapidly with x, and most of the ions accumulate in the vicinity of the cathode. At any distance x, the values of n_i and n_e per unit volume may differ considerably. Engel plotted the distribution curves for n_i and n_e before ignition in the case of a planar electrode; because wall recombination occurs in the capillary tube, charged particles are lost and the distribution curve is essentially as shown in Fig. 3.

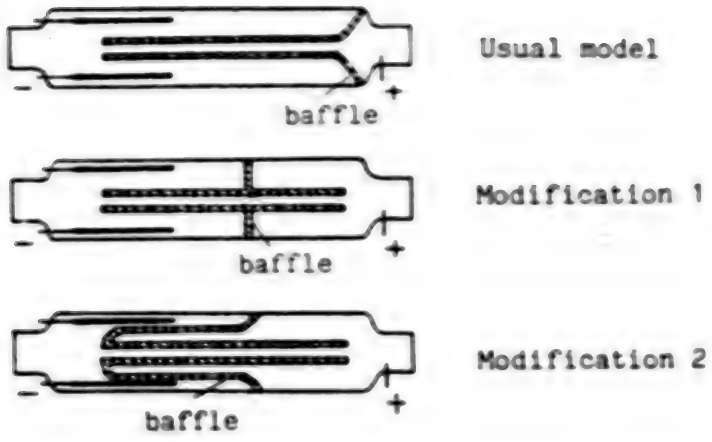

Fig. 1. Design of the three laser tubes

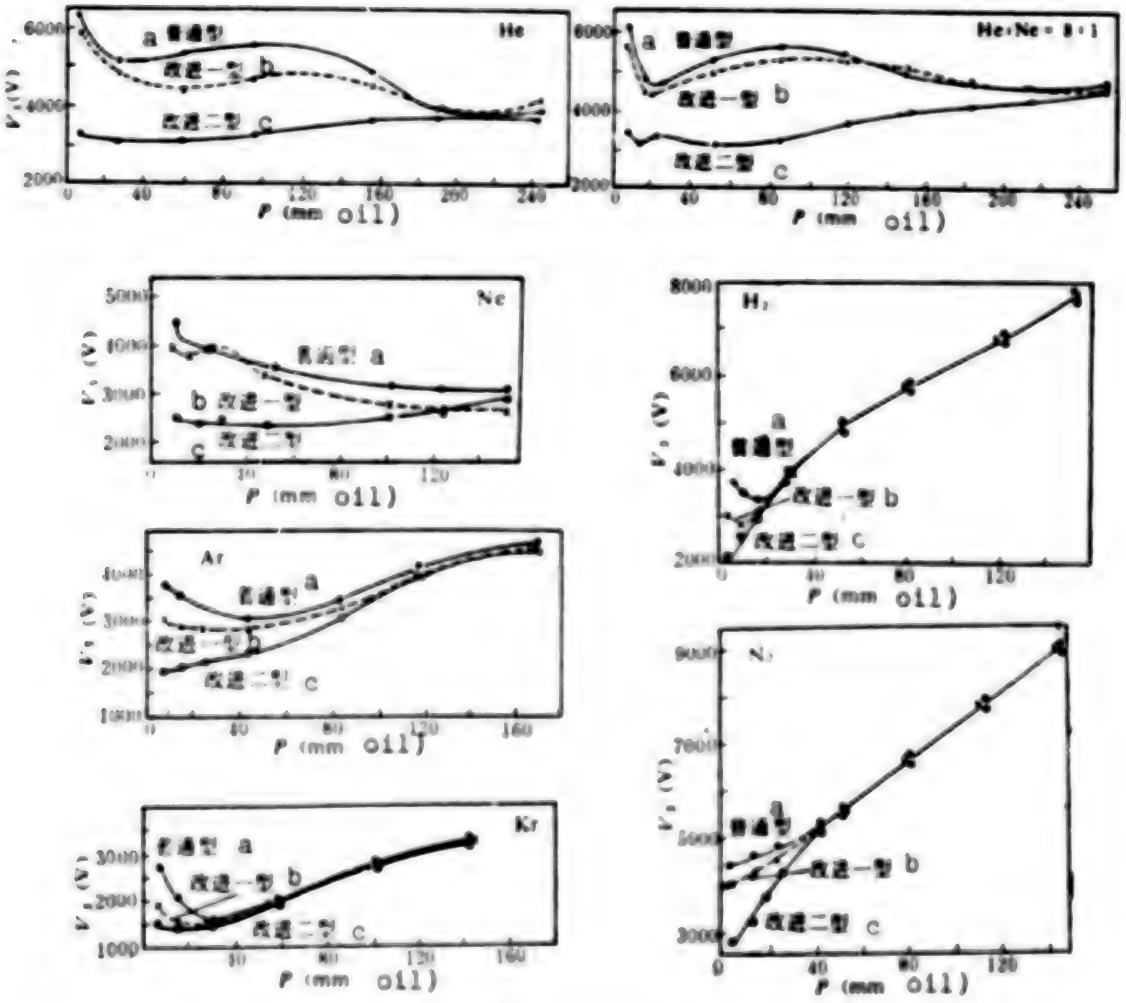

Fig. 2. Ignition voltage V_s vs pressure P for the three tube types

Table 1. Values of P_o for several gases

Gas	He:Ne(8:1)	He	Ne	Ar	Kr	H_2	N_2
P_o (mm oil)	214	191	125	100	28	25	30
P_o (torr)	17.2	15.3	10.04	8	2.25	2	2.4

Note: No. 275 silicone oil was used in the oil columns

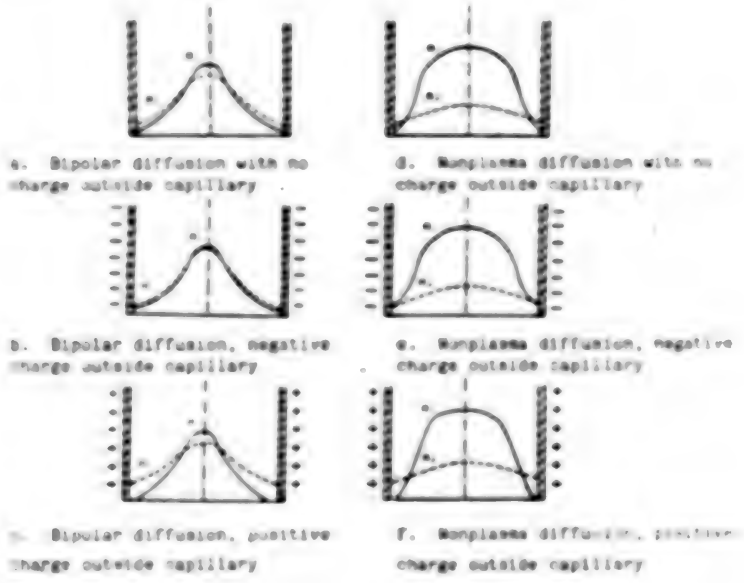

Fig. 4. Instantaneous electron and positive ion distributions

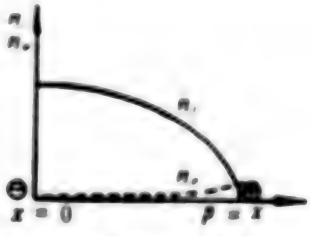

Fig. 3. Charged particle distribution in capillary before ignition

Fig. 5.

Table 2. Migration rates and diffusion constants for inert-gas ions

Ion	He^+	Ne^+	Ar^+	Kr^+	Xe^+
Migration rate K, 1 torr, 0° C (cm/sec per V/cm)	8	3.3	1.2	0.89	0.44
Diffusion constant K, 1 torr (cm^2/sec)	380	~120	47	17	12

Note: Diffusion constants are those calculated by Engel for high-purity gas.

Below we concentrate on two problems.

A. Mechanism of Ignition Voltage Lowering in the Modified Tubes

When analyzing the mechanism of ignition voltage lowering, we must consider chiefly the effect on α and W when positive charges in the vicinity of the anode surround the capillary tube.

1. Effect of the Charge Surrounding the Capillary Tube on α

As we know, α and the field intensity E are logarithmically related, so that a miniscule increase in E will produce a rapid increase in α.

During the avalanche buildup, free electric charges gradually appear inside and outside of the capillary tube. But the free charge distributions differ in the three tube types. In the ordinary tube the area outside the tube is filled by negative charges, some of which neutralize the electric displacement lines from the anode, so that the electric field produced by the anode in the vicinity of the cathode and in the capillary tube is weak, decreasing the value of α everywhere, and the avalanche effect is accordingly weakened. In modification 1, the left side of the area outside the capillary tube is filled by electrons and the right side is filled by positively-charged particles; the presence of the latter strengthens the effect of the anode on the cathode region and increases the electric field inside the capillary tube, which promotes avalanche propagation. In modification 2, because the positive ions extend out even farther, the field values in the cathode area and inside the capillary tube are increased even more and the avalanche effect is improved. Thus it is easy to see that the ignition voltage will be lowest in modification 2, higher in modification 1, and highest in the ordinary tube.

2. Effect of the Charge Outside the Capillary Tube on W

Under usual conditions, spatial recombination can be neglected [9, 10]. The probability of recombination with the walls is determined as follows. Because electrons have a high speed of thermal motion, they are the first to diffuse to the walls, giving them a negative potential, which then attracts positively charged ions to the walls, where they recombine with the electrons. Under stable conditions equal numbers of electrons and ions reach the walls, but the walls maintain a permanent negatively charged layer and thus have an abundance of electrons.

In order to elucidate the effect of the surrounding charge on W, we first assume that the capillary tube contains a plasma, then discuss the non-plasma case. Ignition belongs to the latter case, but since bipolar diffusion theory is relatively mature, it is a suitable basis for the discussion.

a. When the Capillary Tube Contains a Plasma

Can the ions in the capillary tube of an He-Ne laser be treated in terms of the bipolar diffusion theory? Two conditions are required for the bipolar diffusion theory to be applicable [11]: (a) the numerical densities of both the positively charged ions and the electrons must be sufficiently large to maintain a zero static space charge; (b) the gas density must be large enough that the charged particles and molecules will undergo sufficient collisions to establish statistical equilibrium. If the gas density is too low, then the situation will be one of free flight of charged particles in an electric field [12] rather than of diffusion.

Under our experimental conditions (P from 10^{-1} to 20 torr), the electron mean free path [13] was: $\lambda_e = 8.4 \cdot 10^{-1}$-$4.2 \cdot 10^{-3}$ cm (for He), and $\lambda_e = 6.0 \cdot 10^{-1}$-$3.0 \cdot 10^{-3}$ cm (for Ne). With a capillary tube diameter of 0.12 cm, at 3 torr helium will have an average of only 4 molecular collisions in the axial direction inside the tube; thus except at high pressures of nearly 20 torr we must assume that condition (b) is only barely fulfilled. Furthermore, glow discharges generally satisfy condition (a) [14]. Thus the necessary conditions for the bipolar diffusion theory to be applicable are barely fulfilled after igntion.

Before the walls of the tube have been affected by the external electric field, at some instant the electron and positive-ion distributions will be as shown in Fig. 4a.

Because the electron temperature is high (2,000 to 10,000 K) and the ion temperature low (about 500 K), the electron density will be slightly higher in the vicinity of the walls and the ion density will be somewhat larger near the axis of the tube, so that the walls will have a negative potential.

Now, suppose that the exterior of the capillary tube is surrounded by negative charges, so that their lines of force pass through the walls of the tube and affect the plasma. One important characteristic of plasmas is their effect on an externally imposed electric field: when acted upon by the field, they can adjust their free charge distribution to form a sheath that cancels this effect. The Debye length is one measure of this shielding effect. When the external field is negative, the sheath consists of positive charges, and at this time bipolar diffusion is superimposed on the positive-ion sheath, resulting in the distribution shown in Fig. 4b, with a relative increase in the number of positive charges near the walls and a corresponding weakening of the negative charges. Similarly, if the field outside the tube is positive, the distribution of Figs. 4c results, and the negative charge is more concentrated than it would be if produced solely by bipolar diffusion, while the negative charge is greatly decreased.

Comparison of Figs. 4b and 4c gives a qualitative explanation of the effect produced by an external field. The recombination rate of charged particles at the walls is determined by the surface densities of the two types of particles

on the wall surface. But when there is an extreme deficit of one kind of particle, the recombination rate is determined chiefly by the number of particles of this type reaching the surface. In the extreme case, if the number of positive particles arriving is almost equal to zero, then the abundance of electrons at the surface will be even greater, but this will have no effect on recombination.

In Fig. 4b, the two types of particles are present in similar numbers, so that the numbers of particles reaching the surface and recombining per unit time are rather large. In Fig. 4c, because very few positive particles reach the walls, there are very few recombinations. Thus in the former case W is large, and in the latter case it is small.

b. When the Capillary Tube Does Not Contain a Plasma

In the ignition process, the contents of the capillary tube may not be regarded as a plasma. Because of the avalanche process, the number of electrons increases with increasing proximity to the anode, and most of the ions collect near the cathode, a situation which deviates greatly from that of a plasma. According to Engel [15], electron charges are still predominant on the walls, and it is only near the anode that, because of the anode electric field, a positive potential occurs on the walls, as shown in Fig. 5 (Engel's original diagram uses a rather thick cylinder, which the capillary tube resembles). Obviously, under these conditions recombination at the walls will be rather difficult, but the two factors still apply: (1) in the steady state, equal numbers of electrons and ions will arrive at a given area of wall in a given period of time; (2) when an external field is present, the charge distribution will still be adjusted to screen out the external field. Chen [16] has noted that in the case of a system consisting of just one type of charged particle or a nonneutral plasma system, the Debye shielding effect will still be manifested as a change of conditions.

If we consider the distributions of n_e and n_i for a cross section and assume that in the absence of an external field they are as shown in Fig. 4d, then in the presence of an external field they will be converted to those shown in Figs. 4e and 4f.

As in the case of the plasma, we readily see that of a negative surrounding charge outside the capillary tube will increase W and a positive charge will decrease it.

The above discussion indicates how the new tube design lowers the ignition voltage in the vicinity of the anode: the capillary tube is surrounded by positive ions, increasing the value of α inside the tube and decreasing W. However, experiments will be needed in order to determine which of these two quantities is the more important.

B. Differences in Gas Behavior in the Improved Tube Models

Two conclusions may be drawn from the measured ignition voltages for the gases tested: (a) the values of P_0 for inert gases are fall into the order $P_{Ne}>P_{He}>P_{Ar}>P_{Kr}$; (b) the values of P_0 for the molecular gases N_2 and H_2 are generally lower than those for the inert gases (except for Kr). We propose the following explanations.

1. Explanation of the Sequence $P_{Ne}>P_{He}>P_{Ar}>P_{Kr}$. In the new tubes, the positive ions surrounding the capillary tube diffuse and migrate there from the vicinity of the anode. Two processes cause the positive ions to move away from the anode, namely diffusion resulting from the density difference, and migration caused by the electrical field of the anode. The migration rate and diffusion constant for positive inert gas ions in their respective gases are shown in Table 2 [18], which indicates that He^+ can escape to the greatest distance, followed in order by Ne^+, Ar^+ and Kr^+. At high pressures, both diffusion and migration become very difficult. They continue to be effective only in He and Ne, which have rather large values of the migration rate K and the diffusion constant D; this is the reason for the observed order of P_0 values.

Actually, what is observed in the experiments is expansion of the discharge glow in the vicinity of the anode outward to a greater distance around the capillary tube as the pressure decreases. Expansion of the discharge glow for Ar and Kr at a given pressure appears extremely difficult; there is only a bright glow near the anode which becomes extremely weak a small distance away.

2. Explanation of the Extremely Low Values of P_0 for Molecular Gases. It is difficult to explain this problem in terms of the diffusion coefficient and migation rate: we must start from the obvious differences in the V_s-P characteristics of the capillary tube for H_2 and N_2 and the inert gases. It can be seen from the V_s-P characteristics for H_2, N_2, He and Ne given in an earlier article [7] that the right branches of the curves for H_2 and N_2 rise very rapidly. Consequently, when the pressure rises, although the ions can penetrate to a considerable distance, their effect is cancelled by the fact that the capillary tube requires a rather high ignition voltage. For He, Ne and the like, on the other hand, the right branch of the V_s-P curve is rather flat from a few torr to 20-30 torr, so that at high pressures the ignition voltage still decreases somewhat, but because penetrating ions collide with gas molecules, they cannot travel far, and the effect gradually decreases.

Because the V_s-P characteristic is rather flat for the He-Ne mixture, its microscopic mechanism may be level-by-level ionization in the course of the He-Ne avalanche discharge.

This project was proposed by Comrade Cheng Zedong [4453 3419 2639] of Department 5 of this institute, and we take this occasion to express our thanks.

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8480
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EDITOR FOR CHINESE VERSION OF dBASE II DESCRIBED

Shenyang XIAOXING WEIXING JISUANJI XITONG [MINI-MICRO SYSTEMS] in Chinese No 12, 8 Dec 85 pp 34-39

[Article by Liu Ziwen [0491 1311 2429]: "A Chinese Character dBASE II Dynamic Editing System"]

As microcomputers are more broadly applied, the Chinese character dBASE II popular on microcomputers is being better understood by users. Many units have expanded the Chinese character functions of the originally imported edition, which has created more conveniences for the users; but the basic commands and their usage have not been changed at all, and especially in the case of the series of commands to revise the database structure, users everywhere have said that the operations are complicated and that these commands are difficult to master for non-computer users. To revise the database structure in the single command mode, the following four steps are generally needed:

1. Copy the database to be altered into a new database file.
2. Use the MODIFY STRUCTURE command to enter full-screen editing of the structure.
3. Add the newly copied database to the revised structure file.
4. Delete the new file, which has now been used.

When revising the FIELD NAME, one must also undertake a series of conversions to standard data format (.SDF), and if not careful this could lead to destruction of the database.

For the reasons described above, this paper proposes a batch processing method (programmed operation) to effect complete revision of a database structure and records, which will improve the efficiency of use and convenience for the user. This auxiliary software tool is already in operation on IBM-PC (XT) microcomputers. It is an applications software system, called ED3 hereafter.

I. Regarding the dynamic technique of dBASE II

What is dBASE II's dynamic technique? Generally speaking, it is to use a programmed format to control and manage databases. That is, one uses the command language provided by dBASE II to write programs that accomplish the

management of databases. Work with databases has two primary tasks: setting up the database and managing the database. Setting up the database includes design of the structure model and input of the data. Setting up the data structure model is designed with a view toward data retrieval, statistics, and reporting, which is to combine items for different applications into an appropriate data structure; as for the editing and updating of data, this is always related to the field variables within the data structure, and includes the usage of storage variables as provided in dBASE II, provided primarily for updating and editing field variables. Therefore, when we use dBASE II to solve real problems it is primarily through flexible control of a series of commands relating to field variables, the most important among which are the various methods by which to use dynamic techniques to process field variables. Commonly used dynamic techniques in dBASE II include the following three areas:

A. Technique to dynamically locate and replace updated field variables.

In large volume real applications, to update field variables (that is, to change the current field variable values), we often use the locate command in programs: LOCA [<scope>] [FOR <expression>] and the replace command: REPL [<scope>] <field name 1> WITH <expression 1>, . . . [FOR <expression>]. That is, according to the requirements of a particular condition, to update certain fields within records with the locate command. Sometimes, when LOCATE, INSERT [BLANK], and REPL are used together in a program, it can be extremely effective for updating certain fields in a record.

B. Technique using the dual-region operational principle to derive an offspring database.

This is to use the dual-range operational principle of dBASE II, the principle (SELE) where the databases are shifted after preselecting the primary (PRIM) and secondary (SECO) regions, where some offspring databases are derived from the parent database. Afterwards, each offspring database shares the manner of the parent database to constitute the values for the field variables in the offspring database. In warehouse management, it is very useful for example in the process by which the various negotiable instruments and receipts are created when the storekeeper makes deliveries to customers. To use the programmed format to accomplish the idea discussed above, we could divide the process into the following steps:

1. From the parent database, copy an offspring database having only the fields desired (just structure, no data).

2. Select regions. (Such as the parent database as primary, the offspring as secondary.)

3. Input the key field variable values needed by the offspring database in an interactive manner.

4. Locate the position of a record in the parent database.

5. Select the secondary region, and with the APPEND [BLANK] command derive the contents of the first record in the offspring database (with the REPL command), by which information can be exchanged between the two databases.

6. Transfer to region number (select primary region).

Repeat steps 3-6, which will complete derivation of the offspring database.

C. Technique using the specified database structural scheme to edit a data structure.

dBASE II provides a database creation command that expands the structure (COPY TO <transposed database> STRU EXTE). This allows any database that is a USE database to be converted into a transposed database having a standard database structure scheme. That is, the structure of the original database becomes the records of the new database (we call that a transposed database), the structure of which is specified, where the structure of any database is in this fixed scheme:

FLD	NAME	TYPE	WTH	DEC
001	FIELD:NAME	C	010	
002	FIELD:TYPE	C	001	
003	FIELD:LEN	N	003	
004	FIELD:DEC	N	003	
** TOTAL **			00018	

Based on this idea, for the revision of the structure of any database, by programming we can then use the dynamic technique described above (with the replace command REPL for edited records) on the specified structure scheme to revise the structure. For revision of field names, we can also arrange for a format conversion command in the design of the program and transmit data using .TXT files. This is the primary reasoning behind EDS.

II. The EDS Programming Techniques

EDS program design is written in the modular structured technique of dBASE II, and is based on the eight editing functions of EDS that are composed of eight sub-modules (see the following flowchart of EDS program branch modules and its explanation); selection of the various functions is explained in the main menu, and any editing function can work interactively. Among those functions, conditional structure, macro commands, and full screen display commands are important components of the EDS program. EDS can operate on the IBM-PC (XT) and compatibles with different drivers, and on a microcomputer with only one drive or with many, they are handled automatically through the program. For the convenience of the user, EDS acts as an auxiliary applications system for dBASE II. It is packed with dBASE II (V. 2.4) on one 5 and 1/4-inch double-sided double-density floppy and is loaded with the driver for A; the database can be on B, but if there is no drive B, it can be on C. In this partial program, one should consider the handling of the drive number in the file name

of the database. That is, in the process of structure editing, the command to add the database file name should be used, as in:

.RENAME <old database> TO <new database>

This command requires that the old and new database files must be on the same drive to use the name exchange function. If the <old database> here is the database used in the program, then in the routine to select randomly the drive number, the drive number in front of the <old database> will be handled the same as the drive number of the database to be revised.

Another characteristic of the EDS programming technique is that it uses the logical relations of the commands themselves. There are strict logical relations in the operation of the majority of single commands in dBASE II, which means that the operations of these commands can be described in a logical diagram. We provide below the chart of operational logic for the EDIT command as an example:

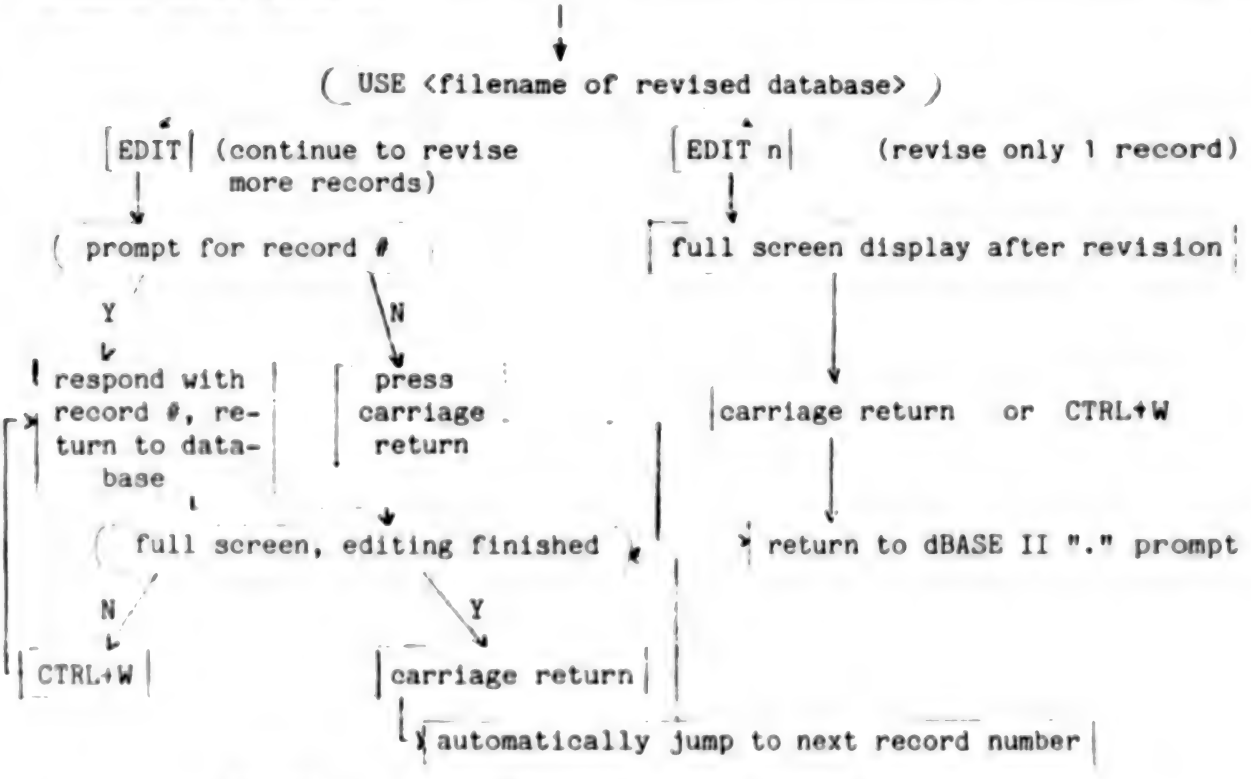

Figure 1. Chart of Operational Logic of EDIT Command

The EDS record editing routines are all written in that kind of logic.

In order to explain the dBASE II dynamic techniques 1 and 3 as discussed in this paper, we provide below a listing of the function module routine to add and delete fields:

```
A> TYPE D1.PRG
SET TALK OFF
SET COLOR TO 2,11
```

```
ERASE
? 'append field, enter: P add field, enter: Q'
WAIT TO H
ACCEPT' now enter database name (including drive number) 'TO KN
STORE T TO LOOP
DO WHILE LOOP
   SET COLOR TO 2,12
   USE &KN
   LIST STRU
   ? "review structure, determine contents to append (insert)"
   WAIT
   USE
   IF H="Q".OR.H="q"
   INPUT "enter field number" TO B
   ENDIF
   ACCEPT 'enter field name' TO C
   ACCEPT 'enter field attribute' TO D
   INPUT 'enter field length' TO E
   IF D='N'.OR.D="n"
      INPUT" enter decimal places; "TO F
   ENDIF
   ERASE
   @ 5,30 SAY "adding (inserting), please wait."
   USE &KN
   COPY TO JNJK STRU EXTE
   USE JNJK
   IF H="Q".OR.H="q"
      GO B
      INSERT BLANK
   ELSE
      APPEND BLANK
   ENDIF
   REPL FIELD:NAME WITH C, FIELD:TYPE WITH D, FIELD:LEN WITH E
   IF D='N'.OR.D='n'
      REPL FIELD:DEC WITH F
   ENDIF
   CREATE &KB FROM JNJK
   USE &KB
   APPEND FROM &KN
   USE
   DELE FILE JNJK
   DELE FILE &KN
   RENAME &KB TO &KN
   USE &KN
   LIST STRU
   ? "review database structure after revision,
        continue to enter (append)? (Y/N) "
   WAIT TO G
   IF G<>'y'.OR.G<>"y"
      RETURN
   ENDIF
ENDDO
```

This is one of the 8 EDS modules, where `&KB' is one of the main module routines, the value of which has already been set through uniform handling of the drive numbers. 'JK' is an intermediary database assigned to drive A so that the EDS program disk should not be write protected. To guard against damage to the EDS and dBASE II V.2.4 disk, it is recommended that a copy be made.

This routine (D1.PRG) is a sub-module routine to interactively add/delete fields. It is called by the main module, and if used alone it would be all right to combine &KB and &KN on the same drive.

The JK database file is an intermediate database generated by the revised database file &KN, that is, the transposed database mentioned under part C of this paper. Its structure is a specified structure scheme and its records are the records of the &KN database. Consequently, the routine can use the replace command REPL to revise (update) the JK records, that is, to revise the structure of &KN.

The first part of the routine (D1.PRG) is to determine whether it is the branch routine for appending fields or adding (inserting) them. Appending fields does not have the problem of a given field number, because it works by adding one field after the last field name in the current structure, while in adding fields, i.e., inserting fields, the field number must be added. Here, the commands APPE BLANK and INSERT BLANK both create the conditions for either appending or inserting a field for the replace command REPL.

Regarding the problem in which when either appending or inserting fields the field attribute must be supplied, when the attribute is numerical, the user must enter the number of decimal places for the field, otherwise it is (C), which does not have this problem.

In the D1.PRG routine, the function of the specified field name in the routine can be seen, for it can allow EDS to become a general application routine. By its use, the structure of any database of any structure can be programmably (dynamically) revised.

III. A Routine Flowchart and an Explanation of Its Function Modules

During operation, all dynamic editing functions, help messages, and results of operations are all provided on a simple Chinese character full screen display. The user, and especially the non-computer user, does not have to use directly the particular commands of dBASE II, nor need a technical explanation first be provided; just by using the main menu and sub-menu displays, the user can quickly accomplish the editing functions. To allow the reader to have an overall understanding of EDS, we have provided below a flowchart for EDS and explanation of the module functions:

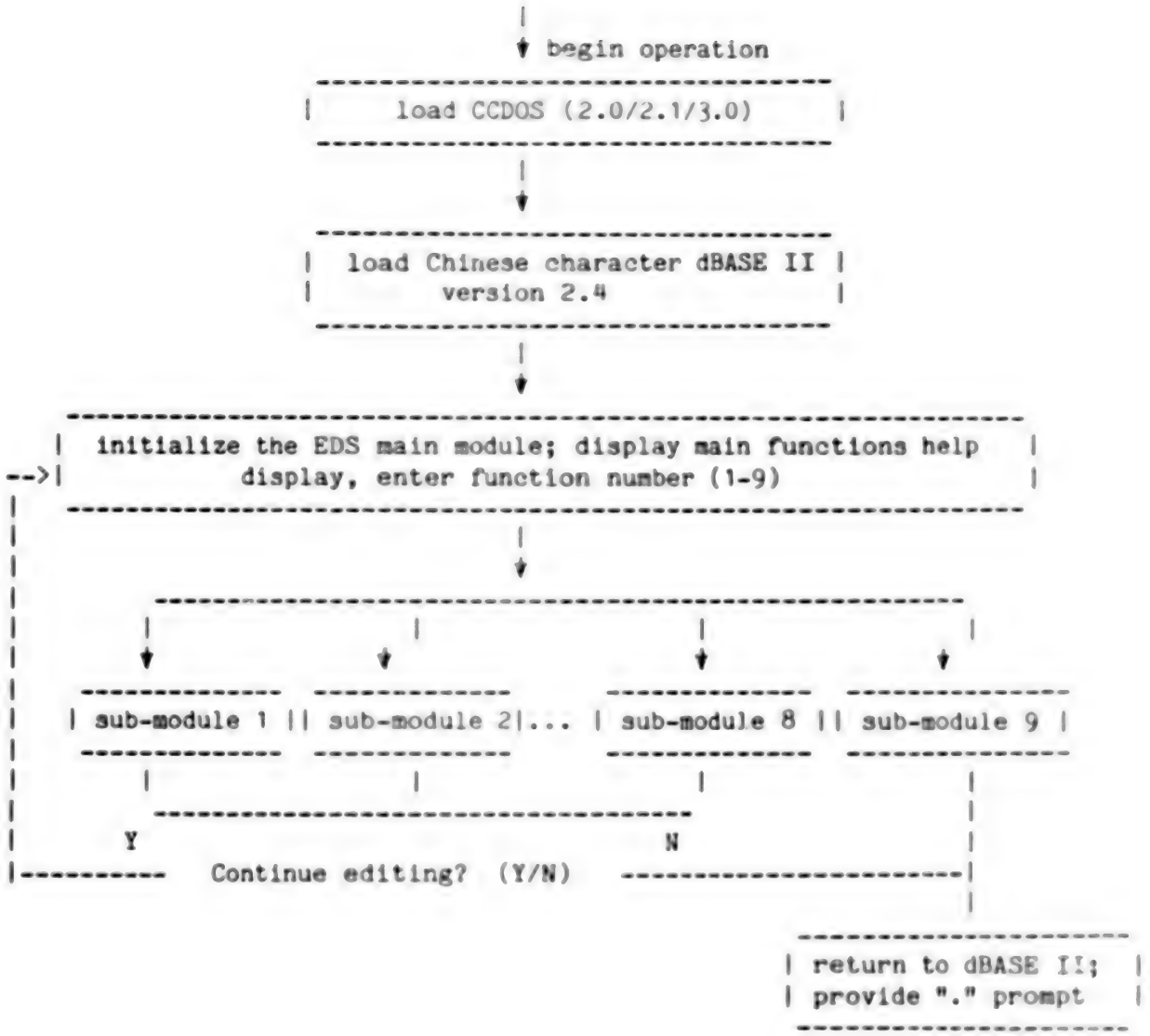

Figure 2. Flowchart for EDS Branch Module

where the main menu function display is as follows:

EDS can automatically perform these functions:

1. Add (append) fields
2. Delete field
3. Revise field attributes (not to include changing field name)
4. Change field name
5. Delete records
6. Append records
7. Change records
8. Insert records
9. Exit

Explanations of the functions of each function module and on entry information are as follows:

[Module 1] function: add field (append or insert).
entry: P~append field: enter field name, type, length.
Q~insert field: enter field #, name, type, and length.
(or, if type is N, must also enter number of decimal places.)

[Module 2] function: delete field (actual delete or just mark for delete or erase record).
entry: field number.

[Module 3] function: change field attribute (does not include changing field name).
entry: field number, type, length, number of decimal places.

[Module 4] function: change field name.
entry: # of field to change, new field name.

[Module 5] function: delete records (mark for deletion, erase deleted record, retain deletion mark, actually delete).
entry: # of 1st record to delete, number of records to delete.

[Module 6] function: append records (may append blank and non-blank records).
entry: P~append blank records; # of blank records to append.
Q~append non-blank records; # of records to append.

[Module 7] function: change records (3 different ways).
1. CHANGE
2. BROWSE
3. EDIT
entry: operate according to detailed prompts on screen.

[Module 8] function: insert records.
entry: number of the record to be inserted (inserted after this number).

[Module 9] function: exit EDS system, display "Goodbye."
entry: press number "9".

IV. Conclusions

According to our own usage and the response from users, EDS functions are complete and operation is simple, especially for non-computer specialist users. Because of the EDS simple and clear interactive operation with Chinese characters, this has made it much easier for the user, and has improved the efficiency of dBASE II use. Some people have said that EDS is a capable aid to use of dBASE II.

Although EDS is a program written with the Chinese character dBASE II V.2.4, any microcomputer that can run the Chinese character dBASE II can use EDS, only the color commands will not work, so it may be run in a broad environment.

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STRENGTHENING OF ENVIRONMENTAL MANAGEMENT DISCUSSED

Beijing ZHONGGUO HUANJING KEXUE [ENVIRONMENTAL SCIENCES IN CHINA] in Chinese Vol 5 No 6, 21 Dec 85 pp 2-5

[Article by Qu Geping [2575 2706 1627], National Environmental Protection Agency: "Strengthening Environmental Management"]

[Text] Editor's note: The National Conference on Urban Environmental Protection held recently in Luoyang was of major importance. The conference studied the most pressing environmental problems now facing China, proposed goals for the Seventh Five-year Plan, and established the guiding ideology and policy measures to be followed. Soon after the conclusion of this conference, the National Conference of Office Chiefs in Departments of Environmental Protection was convened. This article is a summary of the address made by comrade Qu Geping at that conference. The title was added by the editor.

In the past urban environmental protection work was controlled solely by departments of environmental protection. It has since expanded into the realm of mayoral responsibility and all departments concerned are organized to divide the work among themselves. Environmental protection work has also expanded from the individual control projects of the past to the adoption of comprehensive measures to resolve urban environmental problems in their entirety. This is a significant transformation and development, and it is a major indication that environmental management has entered a new phase.

Comprehensive environmental renovation requires that we switch from technical management to more policy-oriented management, and from microeconomic management to more macroeconomic management. Under the present circumstances, in addition to acting as good mayoral staff officers in areas of comprehensive urban renovation and better fulfilling their supervisory and management duties, our environmental protection departments must also enhance their endeavors to control pollution from township enterprises, protect agricultural and natural ecological environments, and so forth.

We achieved notable success in environmental protection work in 1985, and there were particular breakthroughs in aspects of comprehensive renovation in the urban environment. "Handling practical matters" has become a common practice, and the results are beginning to show. According to incomplete statistics from 90 cities, as of the end of August 70 percent of the 559 jobs

(projects) slated for practical handling this year had been accomplished. These jobs fall roughly into the following few areas:

1. Construction of smoke and dust control districts. Many cities have linked smoke and dust elimination to boiler transformation, changed the fuel composition, and pursued central heating. A total of 105 smoke and dust control districts have been constructed, 13,000-plus boilers have been replaced or transformed, chimneys have been cut back by a significant amount, the energy utilization ratio has been improved, and smoke and dust pollution of the atmosphere has been alleviated.

2. Putting pollution contol into effect on key rivers and lakes. In 1985, 92 rivers (or river sectors) and lakes in various locales were reshaped and harnessed. As for pollution control, in combination with industrial regulation many factories that were serious polluters, as well as some improper hospitals, have been closed, halted, or moved; catchment conduits have been constructed; and sewage treatment plants have been built, bringing distinct improvements in river and lake water quality.

3. Control of urban traffic noise. According to statistics from 91 cities, traffic noise control is in effect on 122 streets. Many cities have promulgated laws and regulations to control traffic noise and adopted a series of measures dispersing the flow of vehicles, designating sections of highway on which motorized vehicles are prohibited from blowing their horns, restricting the hours and number of times a horn may be sounded, and replacing loud horns. The traffic noise on controlled sections of highway has generally dropped 3 to 5 decibels.

4. Beautification of the urban environment. Some cities have designated beautification of the living and working environment as a "practical matter" to be tackled. They have built a number of parks and roadside spots of greenery and flower beds, and they have enlarged park regions and planted areas. Extensive emphasis has begun to be placed on urban refuse cleanup and disposal. Many cities have integrated "the five stresses and the four points of beauty" with "the three ardent loves" [the five stresses: improved manners, hygiene, social order, culture, and morality; the four points of beauty: clean language, mind, environment, and behavior; the three ardent loves: love for the CPC, the socialist motherland, and the PLA], and have constructed civilized neighborhoods, shops, depots, and wharves so as to change the appearance of the urban environment.

After the "State Council Stipulations on Enhancing Environmental Management of Township and Neighborhood Enterprises" was issued, most provinces and cities formulated corresponding laws and regulations or detailed enforcement rules, and actively readjusted both the direction of township enterprise development and the product mix. There are 13 provinces and cities that have undertaken experimental work on township enterprise pollution control, and 52 pilot projects have been set up at the county level. Yunnan, Guizhou, and Sichuan--three provinces in which local sulphur production is relatively concentrated--have held a joint conference and made a concrete plan to prevent and cure local sulphur pollution. In Jiangsu, a province in which township enterprise is fairly well-developed, 27 of the 64 counties (or cities) in the province

have instituted township environmental protection personnel. All townships in Yidu and Pingdu counties in Shandong have instituted full-time environmental protection personnel. By and large, those cities and counties which have instituted township environmental protection personnel have all conducted training for them.

Protection of the agricultural ecological environment is one of China's two major environmental protection strategies. In 1985 15 provinces convened the All-province Conference on Ecological Environmental Protection, and the governors of most of the provinces participated and spoke at this conference. To popularize ecological agriculture, 86 test villages (or townships) or test sites have been set up to do ecological farming. There have also been some advances in natural conservation areas: the number of nature reserves nationwide has risen from 137 in 1984 to 262 in 1985, an increase of 89 percent.

After the State Council Commission on Environmental Protection was established, all levels of government enhanced their leadership in environmental protection work. Environmental protection committees were set up in 18 provinces, cities, and autonomous regions. Provincial and local environmental management and scientific monitoring and research organizations were strengthened and enhanced, approximately 800 counties across the nation set up environmental protection bureaus (or offices), and 1,144 monitoring stations were established nationwide.

There is a group of laws and regulations that have been sent straight to the NPC and the State Council for examination, including the following: the revised text of the "Environmental Protection Law"; detailed enforcement regulations for the "Marine Environmental Protection Law" and the "Water Pollution Prevention and Treatment Law"; and revised texts for the "Atmospheric Pollution Prevention and Treatment Law," the "Noise Control Law," and the "Means of Imposing Pollution Discharge Fees." Those drafted by the State Council or issued by ministries or bureaus include the "Methods of Environmental Protection Management on Capital Construction Projects" (revised text), the "Outline on Natural Conservation," the "Red Book on Frequently Endangered Plants," seven "Pollutant Discharge Standards," seven "Method Standards," and the "Farmland Irrigation Water Quality Standards."

There has been sound development in the imposition of pollution discharge fees. In 1984, 750 million yuan was collected nationwide, and 830 million yuan is projected for 1985. The various provinces, cities, and autonomous regions have enhanced their management of the three links (collection, administration, and usage), sorted out the fund accounts held over from the past, and augmented auditing tasks. The fund utilization ratio improved 36.3 percent in 1984 as compared with 1983. First of all, the imposition of pollution discharge fees has accelerated the control of established pollution sources. For example, in 1984 Shanghai Municipality invested 35.34 million yuan to bring pollution sources under control. A total of 121 enterprises made progress in controlling pollution, of which 73 stopped paying pollution discharge fees and 48 reduced their pollution discharge fees, and wastewater treatment reached 670,000 tons per day. Second, the creation of new pollution sources has been brought under control and the proportion of treatment

measures that work has been improved. Since Jiangsu, Shandong, Liaoning, Tianjin, and Guangdong have been collecting pollution discharge fees the proportion of the "three simultaneous efforts" executed and the proportion of treatment measures that work have improved year after year. Third, channels of environmental protection funding have been opened up. From 1982 to 1984 pollution discharge fees provided 1.38 billion yuan in subsidiary funds for pollution treatment. Fourth, environmental protection departments have been encouraged to strengthen themselves.

A general view of the situation shows three obvious characteristics in environmental protection work during 1985:

First, the State Council has truly made environmental protection the order of the day, and comrade Li Peng has personally taken charge. A conference is held every quarter and a number of major decisions are made. This has given impetus to environmental protection work in provinces, cities, and autonomous regions all over the nation. Environmental protection has been made a major issue on the agenda at every level of government. Governors, mayors, and county magistrates have begun to take personal charge of environmental protection work. Because principal leading comrades have taken personal responsibility, breakthroughs of differing degrees have been attained on some tasks which were difficult to expedite for many years.

Second, the demand that environmental protection "handle practical matters" has been given widespread and serious attention. The vast majority of provinces, cities, and autonomous regions do not stop at general comments and appeals; rather they work hard to handle practical matters and they stress attention to actual results to relieve the masses of the dangers of pollution. Consequently, they have achieved the endorsement and support of the masses. In many places handling practical matters is becoming a system, featuring planning, inspections, and visible results. This is a major advance.

Third, environmental protection has been given serious attention at every level of the NPC and the CPPCC, and it has been supported by many concerned departments. For example, the Standing Committee of the NPC has organized some of its committee members to go to the Hunan-Hubei-Sichuan area to observe environmental protection. The Jiangsu Provincial People's Congress has organized more than 1,000 people to observe the state of urban and rural environmental protection all across the province and check up on implementation of the "Water Pollution Prevention and Treatment Law." This has played a tremendous role in promoting environmental protection work all over the province. With the support and operational coordination of urban building and communications sectors, environmental protection work has made great progress in many cities, resolving a number of old and difficult problems.

However, we must also realize that development has been uneven all over. It is still common for laws to be ignored or for enforcement to be lax, and there has been no fundamental change in the weak, toothless state of environmental management. An overview of the situation shows that atmospheric and water pollution are still expanding and the environmental conditions confronting us remain grim.

Consequently, in 1986 we must make comprehensive enhancement of environmental management our guiding ideology and our priority task. Vice Premier Li Peng has pointed out that environmental tasks facing China are difficult, but our nation is still not prosperous and we cannot yet funnel a great deal of money into environmental protection. Practice proves that many of our environmental problems can be controlled or resolved through strengthened management. In view of these two points, we must make enhancement of environmental protection our priority environmental protection task.

Environmental management encompasses many things, but the key link for us is to enhance environmental supervision. Today we must particularly stress strengthening the supervisory functions of environmental management departments.

The emphasis in environmental supervision should be on the following tasks:

1. Put supervisory environmental management into effect on all new construction, reconstruction, and expansion projects. This primarily encompasses two areas: first, supervised execution of the system of "environmental impact statements"; and second, supervised execution of the system of "three simultaneous efforts." These are two complementary stipulations that call for comprehensive implementation. According to statistics, only about 75 percent of medium-sized and large construction projects carry out the "three simultaneous efforts," though if we add in those that partially fulfill this responsibility the proportion may reach 90 percent. In some provinces and cities there is 100 percent compliance, but in others implementation is grossly unsatisfactory. The responsibility lies primarily with departments of environmental management. "The three simultaneous efforts" absolutely must be rigorously implemented on new construction projects, and haggling on this point is impermissible. We must be resolute: if the "three simultaneous efforts" are not put into effect, then the construction project will not be allowed. In site selection, examination and approval of "environmental impact statements," checking and acceptance of completed projects, and postproduction environmental results, environmental protection departments ranging from the various provinces, autonomous regions, and centrally administered municipalities on down to the counties must firmly exercise this power and ensure that everything is satisfactory.

Small enterprises must also strictly supervise management. Though township enterprises need not make "environmental impact statements," they must fill in "environmental impact forms" and undergo examination and approval. In managing township enterprises, first the product mix must be rational, second the site selection must be appropriate, and third the "three simultaneous efforts" must be firmly implemented wherever pollution occurs.

2. Put supervisory environmental management into effect in transforming the technology of established enterprises. The State Council has already issued a resolution to this effect. In implementing the Seventh Five-year Plan we must conscientiously adhere to this document, make it the basis for preventing and treating pollution from established sources, and consider it a powerful weapon.

In its Recommendations Concerning the Seventh Five-year Plan, the CPC Central Committee proposed that "We must eliminate products which consume a great deal of energy, are low in quality, or which seriously pollute the environment, as well as backward technology and equipment." This is the spirit of the central authorities, and theirs is the power of the imperial sword.

3. Put supervisory environmental management into effect in township and neighborhood enterprises. The CPC Central Committee Recommendations Concerning the Seventh Five-year Plan clearly suggest that our policy for guiding development in township enterprises should be as follows: "Give active aid, plan rationally, give proper guidance, and strengthen management. Generally speaking, the initiation of township enterprises must be based on agriculture and must serve agriculture. The focal point must be to develop farm produce processing industries and pre-production and post-production services such as storage, packaging, transportation, supplies, and marketing. Where conditions are right, provided that state stipulations are complied with and natural resources are protected, enthusiastically expand small-scale mining industries, small hydroelectric industries, and building materials industries. Based on practical needs and local conditions, in the rural parts of economically developed regions processing industries can be developed to coordinate with large-scale industry and serve export needs. ... ...All township enterprises must strive to improve management and administration, raise product quality, improve production techniques, enhance economic results, and take care to prevent pollution of the environment."

4. Put supervisory environmental management into effect in special economic zones and open coastal cities and prefectures. At the Fourth Council on Environmental Protection a relevant stipulation was passed that provided a basis for supervisory environmental management in special economic zones and open coastal cities and prefectures. Many of the open coastal cities are characterized by new construction, and as soon as it is begun great attention must be paid to achieving a satisfactory municipal character. If environmental protection departments put supervision into effect based on principle they might run into problems. However, we must firm up support for them and they must not be afraid. They must take responsibility on behalf of the four modernizations and posterity.

5. Conduct supervision of pollution sources. As far as urban pollution sources are concerned, the focal point is on supervising the "four evils": waste gas or steam, liquid waste, solid waste, and noise. We must establish files on pollution sources and get an idea of how things stand. Based on investigative research, we must exert total control over key pollution sources.

In order to implement effective environmental supervision we must also adopt certain corresponding measures: 1) Promulgate essential environmental laws, regulations, and standards; 2) Strengthen environmental management organizations and improve the level of management; 3) Augment construction of monitoring organizations; 4) Have the masses play a role in supervision.

In short, since the Second National Conference on Environmental Protection issued the demand that matters be handled in a practical fashion, the response

everywhere has been growing stronger and stronger, and in many places has become systematized. We must persevere in these effective methods. The emphasis on environmental management is a reality that conforms to China's national conditions and environmental problems. Consequently, we must give priority to enhancing environmental management during the Seventh Five-year Plan.

12510
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SOCIETY OF ENGINEERING THERMOPHYSICS HOLDS ANNUAL MEETING

Beijing GUOJI HANGKONG [INTERNATIONAL AVIATION] in Chinese No 2, Feb 86 pp 34-35

[Article by Wu Wenquan [0702 2429 2938]]

[Text] The fifth annual conference of the Chinese Society of Engineering Thermophysics was held from 28 October to 1 November 1985 at Suzhou University in Suzhou City. This was the largest conference that has been held since the Society was established: more than 420 representatives attended the conference and nearly 350 papers were presented. The conference also included a small-scale exhibit/meeting to display the results of current technology, to discuss guidelines for expenditure of research funds of the Society, and to review the achievements of basic research during the period of the Sixth Five-Year Plan.

The papers were divided into four categories: engineering thermodynamics and energy resources, aerothermodynamics, theory of heat transfer and mass transfer, and theory of combustion. These papers not only have high technical standards, but they also address issues that are of practical importance for the development of China's economy and national defense.

There were 45 papers in the field of engineering thermodynamics and energy resources; they cover the following topics:

Basic theory and thermodynamic parameters. Specific issues include enthalpy, entropy, maximum usable work, energy transfer, and energy conversion.

System and Cycle. A large number of papers were concerned with this topic; they cover such issues as heat supply system, dynamic recovery of residual heat at low temperatures, geothermal power generation cycle, Stirling cycle, turbo-charged, fluidized coal furnace power generation, steam-injected gas turbine cycle, and joint supply of heat and electricity.

Thermal properties of material and working medium. These papers dealt with the thermal properties of dissociated hydrocarbon gas, combustion coefficient β under the condition of complete combustion of multielement fuel-air mixture, and equilibrium of mixed gas-liquid working medium.

Generally speaking, the study of engineering thermodynamics should be further expanded, particularly in the area of working medium thermal properties.

There were more than 80 papers in the area of aerothermodynamics; most of them are devoted to the subject of impeller mechanisms, others are concerned with the study of air intakes and internal channel flows. To emphasize practical application, two special sessions dealing with the design and experiment of impeller mechanisms are organized. The former includes such topics as the pseudo three-dimensional and complete three-dimensional design methods of side-flow wind machines, low boiling-point working medium, the design of turbine blades for gas turbine containing wet steam and high-power steam turbines, as well as the solution of inverse problems (design problems) and the problem of turbine blade selection. The latter includes subsonic and transonic cascade experiments, the effect of inlet distortion and the effect of blade holes on compressor performance, the treatment of cartridges, engine test under wind-mill conditions, the effect of abrupt temperature rise on engine stability, and the effect of pressure distortion in inlet flow on engine performance. In the area of measurement technology, papers on high-precision pressure measurement system using conventional sensors and two-dimensional color schlieren devices are presented.

More than 20 papers, or about 25 percent, dealt with the subject of numerical computation, which is still an area of considerable interest. Specifically, they cover the following topics: 1) the problem of lattice flow (including the formation of body coordinates, transonic flow calculations, and simultaneous calculation of rotating and static cascades); 2) viscous flow (including viscous expansion in non-orthogonal curvilinear coordinates, basic equations of motion, integral solution of N-S equations, solution to the compressible boundary layer equations, solution to the transonic viscous flow equations, and solution to the three-dimensional incompressible viscous flow equations); and 3) internal flow calculation for air intakes (including supersonic air intake, compressible turbulent flow in an S-bend diffuser with rectangular cross-section, and the formation of ground vortices in an air intake).

There were nearly 120 papers in the area of heat transfer and mass transfer. Their contents touched on many different disciplines and were closely tied to practical applications. They can be divided into the following categories:

Cooling of turbine blades. In addition to the traditional film cooling techniques, several papers discuss the newly developed composite impact-internal cooling and film cooling technique. Actual implementation of intensified cooling techniques in engine are also reported.

Condensation heat transfer. This category includes condensation heat transfer in horizontal pipes, vertical pipes, and pipes with cooling fins.

Natural convection heat transfer. This category includes heat transfer in cavities of different shapes, in sandwich layers, and in vertical walls covered with thin layer of porous material.

Two-phase heat transfer. This category includes gas-liquid two-phase flow in U-tubes, remoistening heat transfer in casings, and evaporation experiments of casing elements.

Boiling heat transfer. This category includes turbulent film boiling of supercooled liquid along a horizontal surface, and the effect of geometric shape and parameters of the porous surface on nuclear boiling heat transfer.

Heat exchangers. The heat exchangers being studied include air cooling units, radiation heat exchangers, helical-plate heat exchangers, heat-pipe heat exchangers, fluid-bed and buried-pipe radiation heat exchangers. These studies all have direct applications.

In addition, papers on the measurement of isothermal coefficients of various mediums were reported.

The numerical calculation of heat transfer and mass transfer is attracting increasing attention. During this conference, several papers discussed the numerical calculation of different forms of heat transfer such as turbulent natural convection in an enclosed space, and the process of rotational flow in a cylindrical combustion chamber. The numerical methods discussed include finite difference method, finite element method for two-dimensional or three-dimensional and steady or non-steady cases.

There were 87 papers in the area of combustion theory. In accordance with China' energy policy, combustion research has shifted from oil burning to coal burning. Specifically, studies in this area include:

Coal-burning fluidized-bed. These papers discuss the research of fundamental characteristics such as pulse fluidized-bed bubble characteristics, depth of penetration of horizontal jets, and high-efficiency sulphur removal. A number of papers presented the results of developing the 2.8 MW circulation fluidized-bed and the experimental results of the charged fluidized-bed; they are representative of the current level of research of China's coal-burning fluidized-beds.

Burning of water/coal mixture. This is another topic of current interest. Several basic research papers and papers on the burning of water/coal mixture in combustion chambers of gas turbines were presented; they will provide a new direction for developing coal-burning gas turbines in this country.

Coal powder combustion intensification technique. Papers in this area were mainly concerned with the application of large velocity-difference co-directional fluidics in a coal powder pre-combustion chamber to achieve intensification and combustion stability.

Combustion in internal combustion engine. Examples include the analysis of intake turbulent flow of a direct-exhaust diesel engine using substitute fuel such as ethanol.

A significant number of achievements in the area of advanced measurement technology were also reported; for example, they include the use of laser-induced fluorescent method to measure the flame temperature and the distribution of OH base concentration, the use of pulse laser microscopic/holographic technique for measuring fog and automatic processing of digital images, and the use of laser doppler device to measure particle velocities. In addition, papers on combustion theory included the numerical calculation and experimental research of the flow field of V-shaped flame stabilizer, the details of numerical calculations (e.g., numerical simulation of coal powder flow combustion in a turbulent separated flow field, and mathematical model of coal powder combustion).

Among the products exhibited, the more popular ones were the laser holographic system for internal combustion engines and the 2.8 MW circulation fluidized-bed coal burning unit.

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